APRIL 1928—THIRTY-FOURTH YEAR

MACHINERY

THE INDUSTRIAL PRESS Publishers. 140-148 LAFAYETTE ST., NEW YORK

APR 3 1928

P576

Insure the best performance of your product by using fool-proof set screws

A MACHINE may render some valuable service or turn out a perfect piece of work, but if it requires constant pampering and servicing, it soon gets the reputation for being more bother than it is worth.

Fool-proof design is a factor in attaining dependable performance, and Bristo hollow safety set screws are a valuable aid in reaching this goal. In the first place, the very nature of the unique socket discourages tampering, and makes the Bristo screw itself fool-proof.

Equally important are the advantages of Bristo set screws over slotted and head screws. Bristos set up tighter and hold better. Being easily handled with a wrench, they can be used in difficult locations. Bristos add to the workmanlike appearance of any job, and a resourceful designer can accomplish wonders with them.

The reason for the greater efficiency of Bristo set screws lies in the unique socket. This is pictured and described in our 28-page bulletin, 819-E, which also gives complete information about the Bristo line. Gladly sent to anyone interested in safety set screws. Write The Bristol Co., Waterbury, Conn.

BRISTO *Safety* **SET SCREWS**

GTD GTD GTD GTD GTD GTD GTD

Motor in the Head

This is the flexible shaft which drives the cylindrical and internal grinding attachments.

It can be removed or replaced in sixty seconds.

The No. 3 GTD Universal Cutter and Reamer Grinder is *new.*

It is clean cut throughout. Extra motors, extra belts and extra expense are all done away with. It is superlatively accurate, due to vibrationless motor running in specially designed ball bearings which handle both thrust and radial loads.

The motor head swivels 90°, which means quick set-up on many jobs.

Get our No. 111 Bulletin and Price List and make your own check with other grinders. We ask no more.

Other GTD

Machine Tools

Hydroil Internal Grinders

Plain Grinders

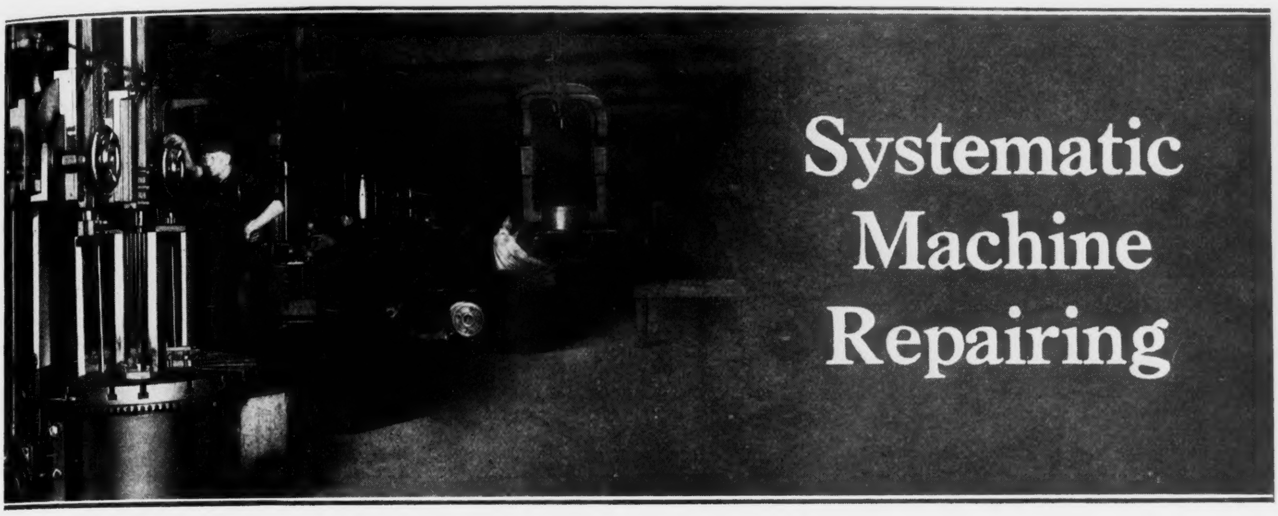
Threading Machines

GREENFIELD TAP AND DIE CORPORATION
GREENFIELD, MASSACHUSETTS

New York—15 Warren St. Chicago—13 So. Clinton St.
Detroit—224-226 W. Congress St.
Canadian Plant—Greenfield Tap & Die Corporation of Canada, Ltd., Galt, Ontario.

MACHINERY

Volume 34 NEW YORK, APRIL, 1928 Number 8



Organization and Operation of a Department with Two Hundred and Fifty Men Engaged in Machine Maintenance Work

By BENJAMIN HANTMAN, General Foreman, Machine Repair Department, Westinghouse Electric & Mfg. Co.

THE main works of the Westinghouse Electric & Mfg. Co., located at East Pittsburgh, Pa., is divided into twenty-one shop departments. All these departments, with the exception of three, are devoted to production. The three exceptions are the maintenance department, which is devoted to the maintenance of buildings and grounds; the tool department, which is devoted to the making and maintenance of tools; and the machine repair department, the functions of which, in part, are described in this article.

Organization of the Machine Repair Department

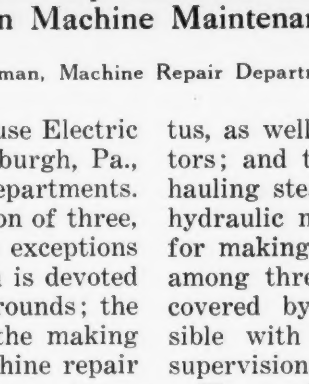
The machine repair department is headed by an assistant superintendent who reports to the works manager, as indicated by the diagram, Fig. 1. On the staff of the assistant superintendent there are a general foreman, master mechanic, production clerk, storekeeper, draftsman, time study man, and accountant. The department is divided into twelve sections, each of which is under a foreman or an assistant foreman. Of the twelve sections, six are engaged in repairing and overhauling machinery.

The six sections consist of a machining section for lathe work; a machining section for work done by other machine tools; a section for fitting and assembling new machine tools and new special shop apparatus, as well as equipping machine tools with motors; and three sections for repairing and overhauling steam cranes, locomotives, machine tools, hydraulic machinery, and special machinery, and for making safety guards. This work is divided among three sections, because of the large area covered by the plant, and because it is possible with this arrangement to provide closer supervision.

The machine repair department employs about six hundred men. Of these, approximately two hundred are engaged in machine repairing, and fifty in building special machine tools and equipping machine tools with motors.

How Machine Repairs are Authorized

Each department in the works has a man known as the "machine tool and fixture supervisor," who reports to the superintendent of that department. These supervisors are expected to know the condition and proper application of the machine tools and fixtures in their respective departments. If a machine requires repairing or overhauling, the foreman issues a requisition on the form shown in Fig. 2 and forwards it to the machine tool and fixture supervisor of the department for his approval. The latter, in turn, sends the requisition to the production



BENJAMIN HANTMAN, general foreman of the machine repair department of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., was born in Pittsburgh, in 1892. He attended the Pittsburgh High School and then entered the Carnegie Institute of Technology, from which he received the Bachelor of Science degree in electrical engineering in 1915. Immediately after graduation, Mr. Hantman entered the Westinghouse student graduate course, but was soon transferred to the New England Westinghouse Co. at East Springfield, Mass. Here he spent time in the cost and trucking departments, but was principally employed in the maintenance and equipment departments, where he was in charge of the millwrights, machinists, pipe fitters, and electricians, and handled the design of necessary machine tool parts. After four years, Mr. Hantman returned, in 1919, to the East Pittsburgh Works and was assigned to the machine repair department of which he is now general foreman.

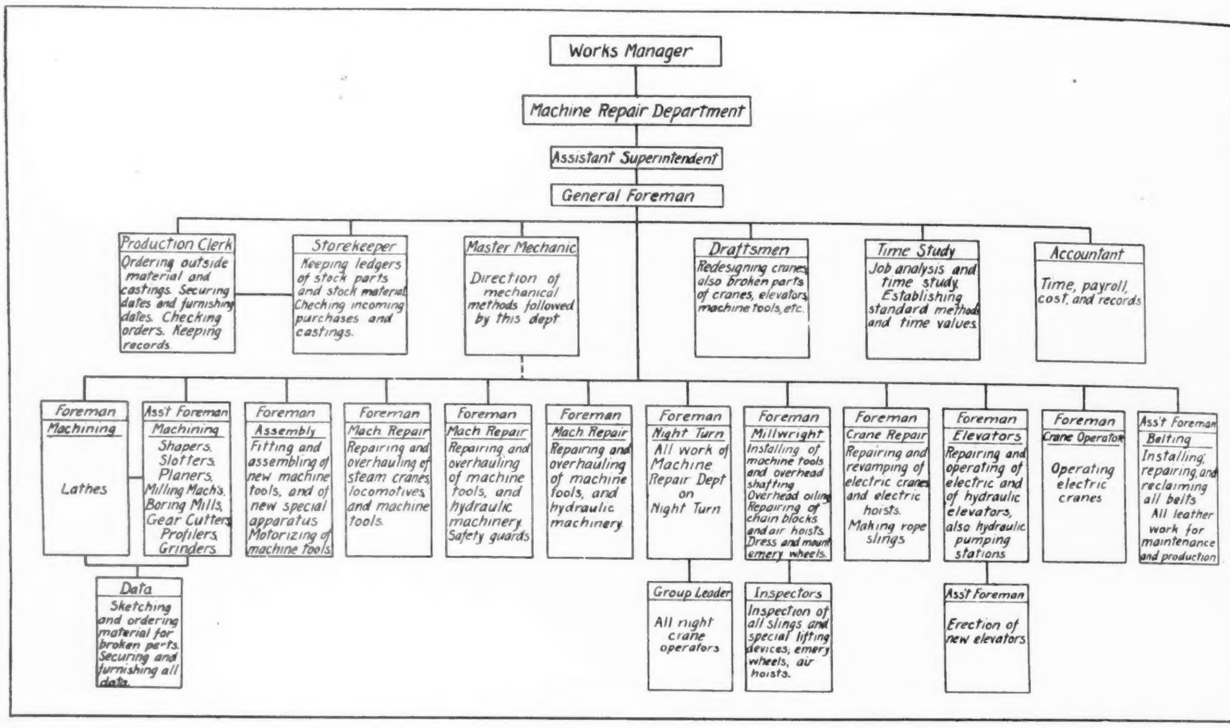
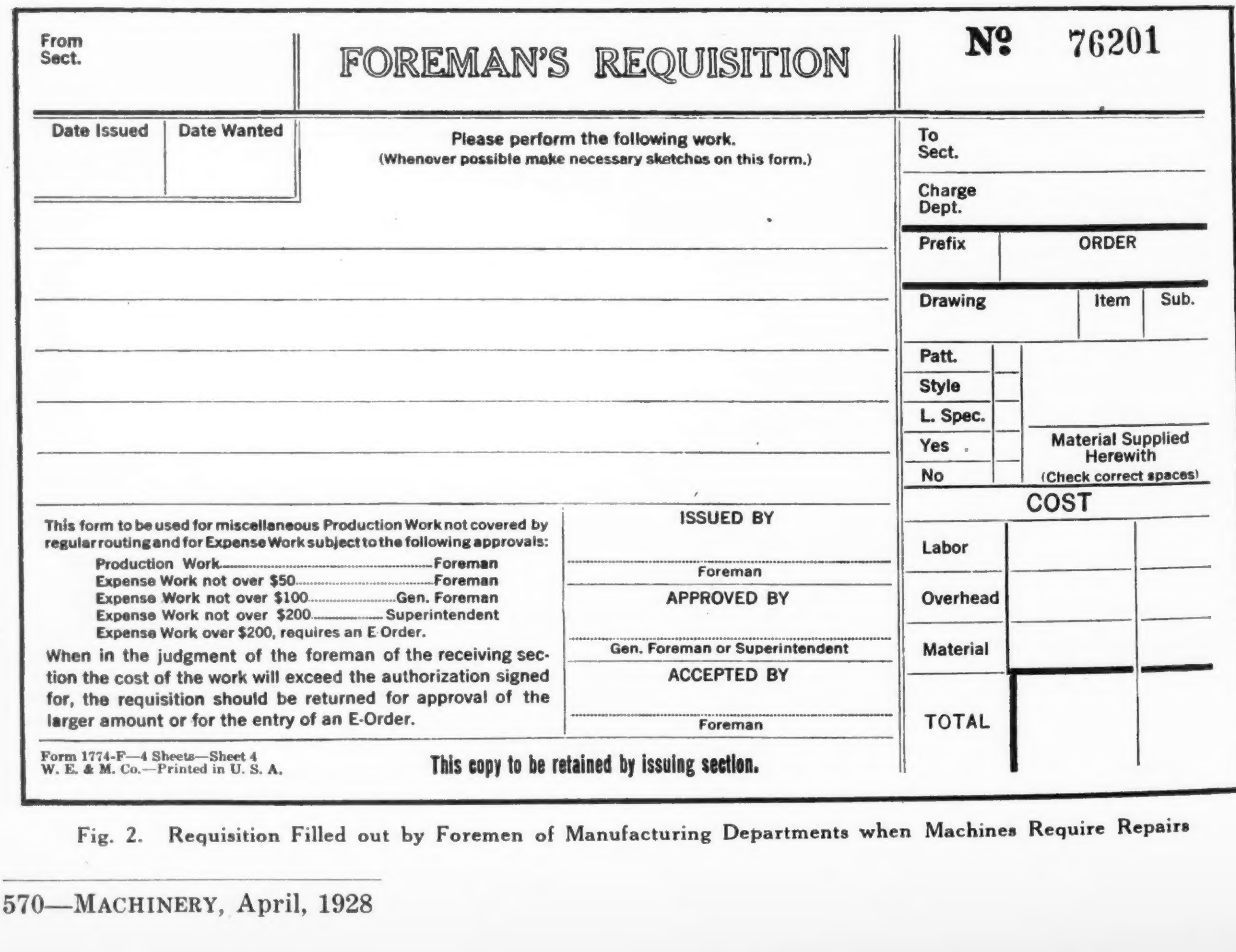


Fig. 1. Diagram Illustrating the Organization of the Westinghouse Machine Repair Department

clerk of the machine repair department, who transcribes the necessary information on a job card such as illustrated in Fig. 5. The job card is handed to the foreman who has charge of repairs in the particular division of the works where the machine is located. For rush work, a red job card is used instead of a white one; and in order to have work of this nature performed as rapidly as possible, a small night force follows through on work started by the day shift.

The foreman to whom the job card has been given has men remove the parts which require repairing. They may be replaced by parts obtained from the manufacturer or from the department stock of spare parts; or they may be made in the machining section. If a part requires remachining only, it is sent to the machining section after being properly tagged. In general, no machines are kept idle waiting for repair parts ordered from the manufacturers of the machines.

The machining sections are equipped with all the machine tools necessary for the work required of them. For instance, there are six gear-hobbers on which gears up to 60 inches in diameter can be cut,



From Sect.

FOREMAN'S REQUISITION

No 76201

Date Issued | Date Wanted

Please perform the following work.
(Whenever possible make necessary sketches on this form.)

To Sect.

Charge Dept.

Prefix | ORDER

Drawing | Item | Sub.

Patt.
Style
L. Spec.
Yes
No

Material Supplied Herewith
(Check correct spaces)

COST
Labor
Overhead
Material
TOTAL

This form to be used for miscellaneous Production Work not covered by regular routing and for Expense Work subject to the following approvals:
Production Work.......Foreman
Expense Work not over $50.......Foreman
Expense Work not over $100.......Gen. Foreman
Expense Work not over $200.......Superintendent
Expense Work over $200, requires an E Order.
When in the judgment of the foreman of the receiving section the cost of the work will exceed the authorization signed for, the requisition should be returned for approval of the larger amount or for the entry of an E-Order.

ISSUED BY
Foreman
APPROVED BY
Gen. Foreman or Superintendent
ACCEPTED BY
Foreman

Form 1774-F—4 Sheets—Sheet 4
W. E. & M. Co.—Printed in U. S. A.

This copy to be retained by issuing section.

Fig. 2. Requisition Filled out by Foremen of Manufacturing Departments when Machines Require Repairs

and two bevel gear planers which handle gears up to 24 inches in diameter.

Westinghouse Electric & Manufacturing Co.
East Pittsburg Works

To Mr.__________ Supt. of__________ Department
Copy to Mr.__________ Works Manager   Month ending__________19__

Summary of Machine Repair Orders Completed.

Section	Order No.	Machine No.	Machine Type	Costs Ordinary Wear	Costs Negligence	Costs Accident	Remarks

Fig. 3. Form on which a Monthly Report of Repairs is Made to Works Manager

Standard Sketches Used for Repair Parts

Realizing the danger of giving verbal instructions to a machine operator, sketches, accompanied by definite written instructions when necessary, are issued. Connected with the machining sections of the department is a man whose sole duties are to make sketches of the parts to be made, specify the material to be used, and obtain and furnish all necessary information. In order to facilitate his work, a number of small blueprints are used, which show the outlines of gears, studs, washers, racks, and other parts frequently made. All the man needs to do is to fill in the dimensions and other pertinent information. Fig. 7 illustrates a typical print. When the material for a job is received, this man gives the job card, material, and sketches to the foreman who, in turn, assigns the job to a machine operator.

When a machine tool requires overhauling, it is brought into the machine repair department. There it is completely taken apart, each part being carefully examined and remachined or replaced by a new one, when necessary. For instance, on an engine lathe, the bed, carriage, tailstock, and headstock are replaned; the spindle is remachined; new bearings are made; all necessary scraping is done; and the parts are realigned.

Store-room of the Machine Repair Department

The machine repair department has its own store-room in charge of a storekeeper who reports to the production clerk. The storekeeper maintains a perpetual inventory on his ledgers which enables him to keep an established minimum of supplies. Miscellaneous hardware, finished replacement parts, and cast-iron, steel, and alloy castings are carried in stock.

For the general run of machine tools, such as lathes, turret lathes, drilling and milling machines, and small boring mills, replacement parts are bought direct from the makers of the machines. For larger machine tools, such as large boring mills, planers, etc., of which there are only one or two of the same size in the shop, parts are carried in stock. For instance, a bull-wheel and a complete rack are carried for each large planer; and rough-turned piston-rods for each steam and drop hammer.

Form 3540-B—W. E. & M. Co.—Works Dept.

Tool No.__________ Serial No.__________ Location Sec.__________
Kind of Mach.__________
Description and Remarks__________
Purchase Date__________ Cost__________ Weight__________ Bought From__________
Contract No.__________

COST OF REPAIRS TO MACHINE TOOL

Date Repaired	Cost of Repairs Dol.	Cost of Repairs Cts.	Part Repaired	Date Repaired	Cost of Repairs Dol.	Cost of Repairs Cts.	Part Repaired
							W—Due to Ordinary Wear A—Due to Accident N—Due to Negligence

Fig. 4. Card on which the Costs of Repairs to a Machine Tool are Entered by the Accounting Department

Form 4577-B—W. E. & M. Co.—Printed in U.S.A.

ORDER NUMBER ______ ITEM ______
REQUISITION No. ______
SECTION ______ COLUMN ______
MACHINE ______

DESCRIPTION OF WORK

DATE ISSUED ______
DATE WANTED ______

LABOR RECORD	HOURS Reg.	HOURS O. T.	DATE
STARTED			
FINISHED			

WORKMAN'S NAME	CHECK No.
	GROUP No.
OTHER WORKMEN ON JOB	
	SECTION
Foreman or Group Leader	

Fig. 5. Job Card Issued after the Requisition has been Approved

The stock of raw material consists of bars from 1 to 10 inches in diameter by 18 inches long; disks from 3 to 30 inches in diameter by from 2 to 12 inches thick; and bushings from 2 to 10 inches in diameter by 12 inches long, with various sizes of cores. Patterns for these bushings have interchangeable core-prints, so that a bushing with any size of core can be obtained. Cast-steel gear blanks are also carried in stock.

Requisitions for material and all time tickets are forwarded to the accounting department each day. When the work specified on a requisition has been completed, the foreman returns the job card to the production clerk. The production clerk, having the original requisition, can follow each job, and therefore is in a position to furnish information connected with the work. Upon receiving the completed job card, the production clerk has the foreman write on the back of the requisition a short description of the work performed, at the same time noting the necessity for the repairs, that is, whether they were required because of ordinary wear, negligence, or accident.

The requisition is then forwarded to the accounting department, where the cost of labor, materials, and overhead are calculated and a cost statement is issued to the department which made the requisition. Statements are issued monthly on large jobs, but only upon the completion of small jobs. This department enters the cost of each repair job on a card such as shown in Fig. 4, together with the short description noted on the back of the requisition. These cards are filed according to machine numbers, all the machines being given a serial number when installed.

At the end of each month, the accounting department writes a summary of the repairs in each department on the form illustrated in Fig. 3, and forwards a copy to the superintendent of that department. A resumé of the total is sent to the works manager. Repair costs are thus called to the attention of each superintendent. While this system may appear rather involved, it is, in fact, simple and requires very little of the foremen's time and little clerical help.

Except in the case of a few special machines, when a machine is out of service for repairs, the work is routed to other machines in the same department. Each department is laid out to take care of these cases, in preference to routing the work to another department which has a similar machine. The extra equipment required costs less than the handling, trucking, and clerical work involved in routing the work to another department.

How the Purchase of New Equipment is Decided

Records of repair costs are employed to determine when a machine ought to be scrapped and a new machine installed. Every three months the machine tool and fixture supervisors of the various departments review all their equipment, and when new equipment is desired, they fill out a form such as shown in Fig. 6. The director of works equipment receives these requests and decides when new equipment is advisable and when equipment which has served its purpose in one department can be used to advantage in another department. He also indicates what can be sold as used equipment and what must be scrapped.

To men engaged in reconditioning machine tools, accessibility for repairs is an important factor in the design of shop equipment. It appears to the writer that some machine builders overlook the fact that the equipment may require repairing, and do

W. E. & M. Co.
Works Dept.
Form 2040-C

REQUEST FOR EQUIPMENT

.... WORKS

To Director of Works Equipment   Date .... 19 ......

Would request the following Equipment for Section .... Dept. ....

Description ....

Note:—If equipment wanted is a duplicate of equipment we now have, specify our tool number and list exceptions, if any. If equipment is not like any we have, give complete description specifying extra parts, if any are required. Reasons for request should be completely filled out.

REASON FOR REQUEST

1—Increased Production ....

2—Saving in Cost of Manufacture ....

3—Replacement ....

4—Change in Design ....

5—New Line of Apparatus ....

6—Remarks ....

☐ Quarter ☐ Special Appropriation ☐ No Appropriation
Note:—Indicate in square appropriation to which this request applies.

Requested by .... (Superintendent)   Approved by .... (Works Manager) Date ....

Recommended by .... (Superintendent in Charge Equipment and Methods) Date .... (Director Works Equipment) Date ....

.... (Vice President) Date ....

Fig. 6. Form Filled out by Machine Tool and Fixture Supervisors in Requesting New Equipment

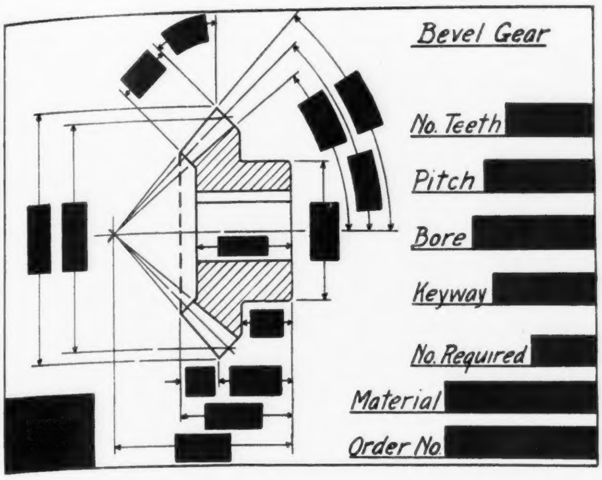


Fig. 7. Standard Sketch which may be Filled in to Suit Different Jobs

not design the machines to give accessibility to certain parts without completely dismantling the machine. Centralized and automatic lubrication reduces costs of repairs, which are often high, because of lubrication failure, when an operator must hunt all over a machine to find the oiling points.

* * *

INTERIOR FORMING TOOL FOR TURRET LATHE

By B. J. STERN

A single-point interior forming tool for use on a turret lathe job is shown in the accompanying illustration. The work consists of finishing the interior of the brass casting shown in dot-and-dash lines to the form indicated by the finish marks. The casting is held in an ordinary three-jaw chuck.

The bracket *A* is fastened to the face of the turret by four cap-screws *B*. A machine-steel slide *C* fits a dovetail slot *D* in the front of this bracket. A gib *E*, adjusted by the gib screw *F*, insures a nice fit for this slide. At the front of slide *C* is a dovetail slot *G* in which another slide *H* travels. A round hub *J* projects from the front side of slide *H*. A plate *K* fastened to the top of slide *C* carries the micrometer dial *L* which provides a means for adjusting the tool-slide *H* up and down by the use of the adjusting screw *M*, which is part of dial *L* and which fits a tapped hole in the top of the tool-slide *H*.

Cut at a convenient angle in the projection *J*, and in back of the center line, is a square slot for the tool bit *O*, which is clamped in place by the set-screws *P*. When the tool-slide *H* is finally adjusted to bring the point of the tool bit into proper contact with the work, the slide can be clamped securely by means of the finger screw *Q*.

Directly in back of the first slide *C* is a drilled hole containing a powerful spring *R* which is retained by screw *S*. The lower end of this spring exerts pressure against plate *T*, which is fastened to slide *C*. This plate contains a hardened plug *U* which is directly under spring *R*. The pressure of spring *R* keeps the plug in contact with a hardened profile plate *V* which is formed to the profile to be imparted to the interior of the work.

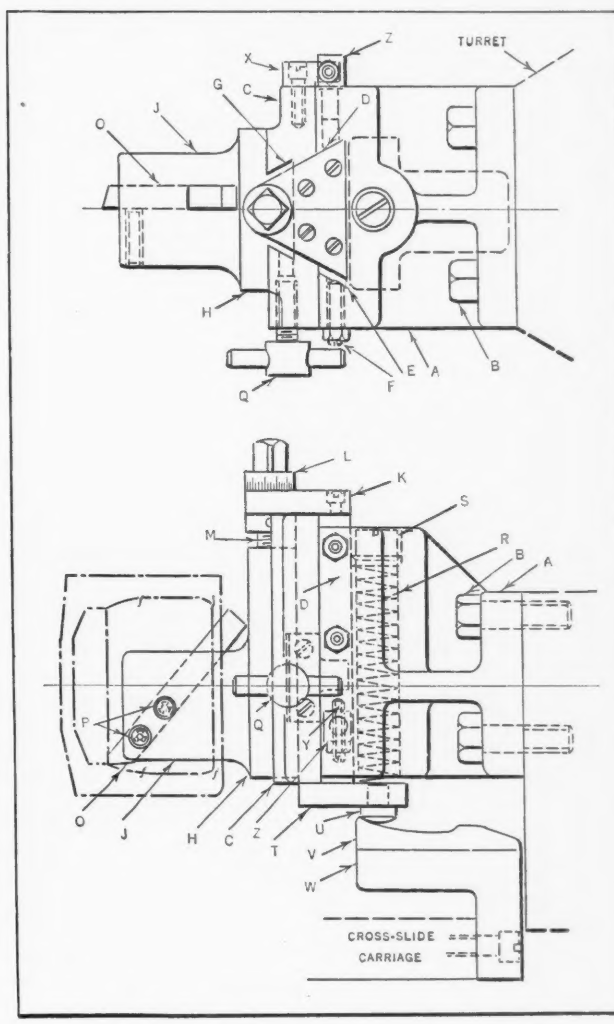
It is evident that plug *U*, traveling over this profile, will cause plate *T* and consequently slide *C* and tool bit *O* to rise and fall in accordance with the profile plate. The profile plate *V* is contained in the bracket *W*, and this bracket is fastened to the cross-slide carriage of the machine which remains stationary throughout the operation. A stop-plate *X*, fastened to the slide *C*, is set to strike a set-screw *Y* which is contained in the plug *Z* driven into bracket *A*.

When the tool is not in operation, slide *C* is kept down against set-screw *Y* by spring *R*. When the turret is brought in for the forming cut, the plug *U*, striking the incline of the profile plate *V*, causes the slide *C* and the tool bit to rise. At the proper point the tool bit enters the work, cutting the desired profile as the plug *U* follows the outline on the profile plate. The turret stop prevents the tool bit from going too far.

* * *

RESEARCH FELLOWSHIPS IN ENGINEERING

Two research fellowships in engineering are to be appointed on April 30 by the University of Wisconsin. Candidates must be graduates of engineering colleges of recognized standing, and, preferably, should have had one or two years of graduate study, of teaching, or of engineering experience. Applications will be received up to April 15. Information and application blanks can be obtained from Dean F. E. Turneaure, College of Engineering, Madison, Wis. The appointments will be for a period of two years, subject to satisfactory service, and the salary will be \$900 for the first year and \$1100 for the second year.



Interior Forming Tool for Turret Lathe Job

What MACHINERY'S Readers Think

Brief Contributions of General Interest are Solicited and Paid for

SPLIT VS. SOLID PULLEYS

In many plants, the constant demand for higher production necessitates the frequent changing of pulleys and the moving of machines to accommodate new equipment. In spite of such conditions, however, the old style solid cast-iron pulleys are still used in many plants. Often, too, the millwright is expected to assemble the drive for a new machine from old pulleys and equipment picked up around the plant, with the result that the speed obtained is only approximately correct.

Every millwright knows that the changing of solid pulleys keyed to assembled shafts is a difficult task and one that frequently necessitates the shutting down of production machines for hours. All this may be avoided by using split pulleys, which can be quickly assembled on a shaft or removed without affecting any other part of the installation.

C. C. HERMANN

TIME SAVED PAYS FOR NEW MACHINES

A shop that was unable to make a profit employed an engineer to make a report on the causes of this condition. He went into the shop and found a great deal of waste caused by the use of worn-out machines. Eleven machines were beyond repair and were still employed in turning out a product, an almost unbelievable percentage of which had to be scrapped. There was considerable discussion among the directors when the report was read, recommending the scrapping of eleven machines and their replacement by new equipment. In addition, repairs running into thousands of dollars were recommended on more than two-thirds of the remaining machines. However, the advice was followed.

After five months of operation with the new machines, it became evident that the losses in time and material due to operating the old machines were sufficiently large to pay for the new machines in three and one-half years. In addition, the scrap was reduced to 2 per cent, as compared with 18 per cent previously.

Much of the scrap due to the use of old machines had been blamed on the workmen, and men had constantly been discharged because they failed to produce good work. Thus, keeping old machines in operation was an injustice not only to the stockholders, but also to the workmen, and the installation of new equipment reduced the labor turnover.

At the present time, conferences are held from time to time in this shop, at which new machines that are advertised are discussed; and when a machine appears to be capable of reducing the present operating time, there is a willingness to buy it, which was completely lacking in the past.

RUSSELL J. WALDO

AIDING EFFICIENCY BY SHOP CAFETERIA

Most of the big shops have cafeterias for their employes, but in the small shop the cafeteria presents quite a problem. Space, equipment, cooking facilities, chef, and assistants are required. The cost of equipping a cafeteria to seat 500 men runs from $4000 to $4500.

In one successful shop cafeteria, arranged like regular commercial cafeterias, the managerial duties are assumed by one of the shop executives. The cashier and checkers are office workers who act in these capacities during the lunch hour. The workers lunch in two shifts—first the shop, then the office force.

The results of having a cafeteria are noteworthy. There is an improvement in the cleanliness of the shop—the workmen no longer need to use the top of their work-bench as a dining table, and no remains of meals are left around the shop. Labor turnover has been reduced to a minimum, and there is an improvement in the general morale of the workers.

SAMUEL KAUFFMAN

WHERE EXPERT ADVICE IS NEEDED

Another comment on the question of expert advice that seems pertinent is that the expert seems to be required only for technical problems, while everybody thinks himself capable of handling the most difficult problem in industry today—that of employe relations. Gradually, managers are beginning to realize that the man power necessary to operate the machine power efficiently is, after all, their greatest asset.

It is nevertheless a singular fact that many executives who hesitate to handle simple mechan-

What Do You Think?

Should a machine tool dealer take old machines in trade when selling new equipment? One of our readers (himself a machine tool dealer) thinks if this custom were abolished, the whole level of the business would be raised. What is your opinion?

A vital problem confronting the machine tool industry is the question of "free service." To what extent can a manufacturer afford to render free service?

How designers can benefit by taking advantage of the experience of operators is pointed out by another reader. The operator who uses a machine every day naturally becomes familiar with its advantages and deficiencies. His experience places him in a position to give valuable advice to the designer on possible improvements. Why not take advantage of his knowledge?

ical problems without expert advice will undertake to handle intricate problems of employe relationship without any hesitancy whatever. They will summon legal advice to interpret a contract, but attempt to handle the motives and emotions of thousands of employes without any assistance. It seems to me that too little is thought of the importance of the mental processes of the men in the shop. No industrial organization is so big or important that it can afford to ignore the cooperation of its employes. A. EYLES

DESIGNERS SHOULD CONSULT OPERATORS

In the twenty-seven years that I have been identified with the machinist's trade, I cannot recall a single instance where a manufacturer or designer of machine tools has asked the experienced workmen in our shop for suggestions on improvements that would promote the efficiency of machine tools.

Designers are men of technical training, and doubtless feel that they need not consult the operator. They are, as a rule, thoroughly informed on the qualities of the metals used, the best methods of applying motive power, details of construction for obtaining accuracy and precision, fool-proof devices, reduction of friction, and many other features which are making the machine tools of today so great an improvement on the products of the past.

Designers should not forget, however, that the experienced operator who has to use the machines every day sees the problems of machine tool design from a different angle, and learns to appreciate the good points of the machines, as well as their deficiencies, in a way that the designer cannot do; hence, a still speedier development of machine tools would be possible if there were a thorough spirit of cooperation between designers and those who actually operate their machines in everyday work.

ALBERT MILTON THOMAS

SHOULD MACHINE TOOL DEALERS SELL USED MACHINERY?

The writer is a machine tool dealer who believes that it is the dealer's function to sell new machines for the manufacturers whom he represents and that the business of dealing in used or second-hand machines should be left to those who specialize in used machinery. There is no more reason for a machine tool dealer to take an old machine in trade when he sells a new machine to a customer than there is for a clothing merchant to take an old overcoat in trade when he sells a man a new one. One idea is just as absurd as the other; and yet, because of tradition and custom it has been sanctioned in the case of machines, while it would be considered ridiculous in almost any other line of merchandise (except automobiles).

In view of this, it is with both pleasure and pride that the writer notes that several important machine tool dealers have decided to leave the used machinery business to those specializing in that field and devote themselves exclusively to new machines. If a customer has a machine that he wishes to dispose of when he buys a new one, the dealer aids him by putting him in touch with a reliable second-hand machinery dealer. Should he wish to have the deal go through the hands of the man who sells him the new machine, that can be done by simply allowing the customer the same amount for the old machine that the second-hand machinery dealer has offered to pay, the machine being shipped directly to the latter.

It is hoped that before long all the dealers in new machine tools will follow this custom and thereby place the business on a higher level. It should not be forgotten in this connection that the custom of taking old machines in trade has often been abused, and made a vehicle for price-cutting by allowing an exorbitant amount for the old machine. By divorcing the sales of new machines from the second-hand market, the whole level of the business transaction is raised.

MACHINE TOOL DEALER

ARE SERVICE REQUIREMENTS BECOMING EXCESSIVE?

Many machine tool builders feel that the demands for service on the part of some of their large customers have exceeded the bounds of what might be considered "reasonable." Complaints made regarding the functioning of a machine are often due wholly to lack of skill and experience in the operators—sometimes, it is said, to lack of experience even on the part of their supervisors.

In one instance, for example, the services of a demonstrator were requested by a large manufacturer because the spindles in a certain line of machines did not function properly. An experienced man was sent to the customer's plant some 700 miles away, only to find that the spindles that gave trouble had been made and mounted in the machines by the customer himself, and the trouble was due to inaccuracies in making the spindles and lack of experience in mounting them in the bearings of the machine. In spite of the fact that the trouble, therefore, was wholly due to the customer's own work, he was insistent that he was entitled to service in getting these spindles to run properly; and at the present writing, the question of who is to pay the demonstrator's expenses is still undecided.

In another instance, a telegram was received from a large manufacturer, signed by the head of the purchasing department, asking that a machine tool builder send an engineering representative immediately. The machine tool builder sent his best engineer, who took the night train and arrived at the customer's plant the following morning. Upon arrival, he found that the head of the purchasing department had not sent the telegram, although it was signed by him, and several hours' efforts proved fruitless in finding out who had sent it. No one knew the reason why the machine tool builder's representative was wanted, and there was nothing for him to do but to return home; however, an expense of nearly $100 had to be met by the machine tool builder for no purpose whatever. Cases of this kind, of course, are unusual, but inasmuch as they occasionally do happen, it may be of value to call attention to them.

MACHINE TOOL MANUFACTURER

Modern Shop Transportation Methods

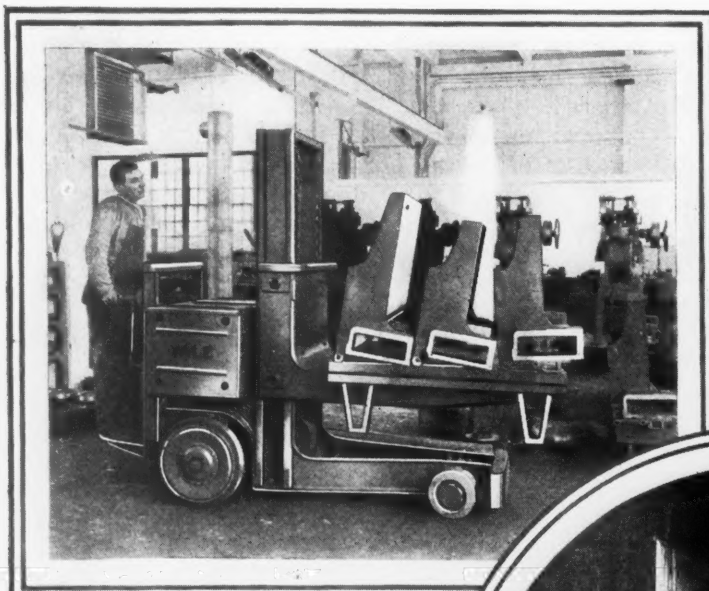


Fig. 1. Elevating Platform Electric Truck, which has Eliminated Several Hand Trucks

IT is not only through the installation of efficient machine tools that costs may be reduced in the operation of a shop. A great deal can also be saved by using modern methods of transporting materials and parts between different departments. The accompanying illustrations show a number of examples of both electric and hand lift trucks used for different purposes.

Fig. 1 shows a Yale electric industrial truck by means of which the work of several men was dispensed with, as compared with transporting work by former methods. Fig. 2 shows an Elwell Parker truck used in transporting castings between the foundry and the machine shop, while Fig. 4 shows two Crescent trucks employed in similar service. It is surprising to learn what savings have been effected in some plants by a thorough study of shop transportation methods and the application of modern equipment. The saving in wages alone is a very considerable item.

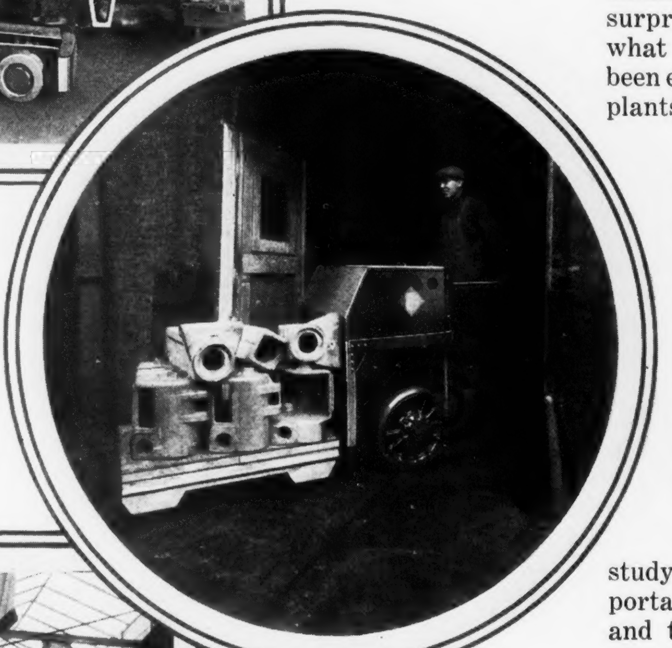
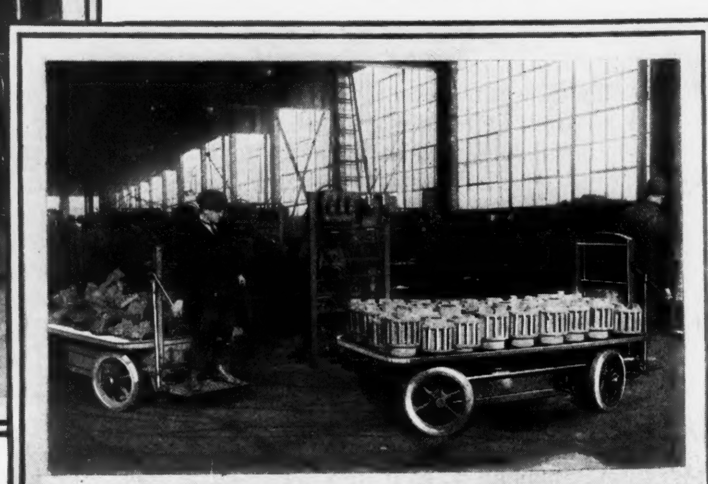


Fig. 2. Electric Truck Used for Carrying Castings from Foundry to Machine Shop and between Machine Shop Departments. The Castings are Handled More Quickly, Less Storage Space is Needed, and Machine Operators Need not Wait for Work

An interesting application of a Baker locomotive crane type of truck is shown in Fig. 3. This

Fig. 3. Locomotive Crane Type Truck Used to Install Machines at the National Machine Tool Builders' Exposition

Fig. 4. (Below) Trucks Used for Carrying Patterns and Castings



picture was taken at the recent exposition of the National Machine Tool Builders' Association in Cleveland, where hundreds of machines were placed in position by the use of this convenient lifting and transporting device. The illustration shows a huge casting being placed on the table of a horizontal boring machine.

In Fig. 5 is shown a Cowan hand lift truck used for moving a completed machine by means of platform skids, while Fig. 6 shows how large boxes with angle-iron legs, used in conjunction with an Elwell Parker truck, facilitate the transportation of small parts from the drop-forge shop to the machine shop.

Fig. 6. Transporting Small Parts from a Drop-forge Shop to the Machine Departments

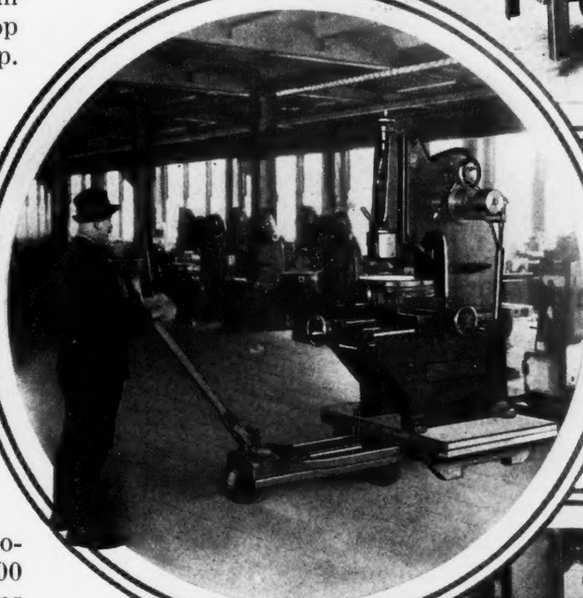
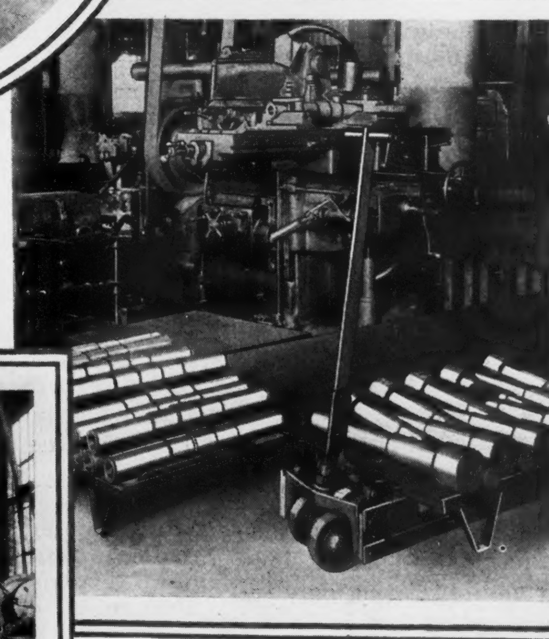


Fig. 5. Hand Lift Trucks Facilitate the Transportation of Entire Machines in the Shop of the Pratt & Whitney Co., Hartford, Conn., Where Many Labor-saving Methods are Adopted to Reduce Handling Costs of Materials and Finished Work

In a large automobile shop, $30,000 was saved in wages alone through the improved trucking methods that were adopted. Even in smaller shops considerable savings can be made in this way. Fig. 7 shows how different lots of similar parts kept on separate platforms are easily moved, a Stuebing hand lift truck being employed in this case, while in Fig. 8 a Crescent electric lift truck is used for carrying platform skids loaded with sheet-metal pans containing small finished parts.



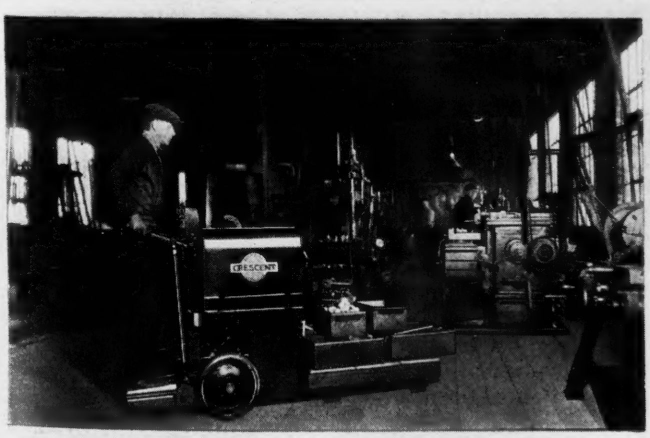


Fig. 7. (Above) Keeping Different Lots of Similar Parts Separated by Means of Platforms Easily Moved about by Hand Lift Trucks

Fig. 8. (Left) Using an Electric Lift Truck for Carrying a Platform Loaded with Sheet Metal Pans Containing Small Finished Parts

It has been repeatedly pointed out that at present the greatest source of waste in many industries is to be found in costly and inefficient methods of handling materials. Modern transportation means will stop such leaks, reduce handling time, and make the work of moving materials and machines easier to perform. The Materials Handling Division of the American Society of Mechanical Engineers is very active in this field, and through its efforts, much valuable information has been made available to the industries.

Soldering and Brazing

Composition and Use of Various Soft, Hard and Silver Solders—Soldering Fluxes

By A. EYLES*

As ordinarily defined, soldering is a process by which the surfaces of similar or dissimilar metals are joined by partial fusion and the insertion of a metallic alloy or solder between them, the solder being more fusible than the metals which it unites. The strength of soldered joints depends largely upon the nature of the solder used and the temperature at which the soldering is done; therefore, the degree of strength required for joints must be kept in view in choosing a solder for a given class of work.

The essential qualities of a good solder are determined by the elements entering into its composition. In order to fulfill its proper function, a solder must be hard, tenacious, and free flowing. It should also, as far as possible, have the same color and approximately the same strength as the product whose surfaces are to be united.

In order that metals soldered together may be securely held, it is necessary that there be more than mere adhesion between the solder and the metal. There must be an alloy formed between the metal and the solder, the solder penetrating into the pores of the metal, and thus making a strong and homogeneous joint. In order that this alloy may be formed, the surfaces of both the solder and the base metal must be chemically clean, and free from oxide. This condition must be maintained until alloying has occurred.

If the base metal happens to be a slowly oxidizing one at the proper soldering temperature, it is usually sufficient to coat the freshly cleaned surface with tallow or some similar substance which prevents access of atmospheric oxygen. In this case, molten solder is applied to clean metal and is enveloped in a layer of molten tallow before any serious oxidation can occur. Under these conditions, the only requirement of a flux is that it should be present during the actual soldering process, so that almost any liquid substance which does not contain free oxygen and which remains liquid without serious decomposition, beyond the soldering temperature, will be suitable. If, however, either the metal surface or the solder is not initially clean but covered with an oxide film of varying depth, some method must be adopted for removing the film. Almost all the inorganic fluxes act in this way, thus enabling clean metal surfaces to come together and alloy.

Two General Classes of Soldering Fluxes

Generally, soldering fluxes are divided into two classes—(1) those preventing the oxidation of a clean or bright metallic surface during soldering; and (2) those that actually serve as cleaning agents. Examples of class (1) are tallow, rosin, palm oil, etc.; examples of class (2) are hydrochloric acid, ammonium chloride and zinc chloride.

Soldering fluxes should not be used indiscriminately, but should be determined by the nature of the work. In some plants, a particular flux is used for most metals and alloys, but this practice is entirely wrong. If iron, steel (tinned, terne, or stainless), brass, copper, lead, nickel or monel metal is to be soldered, zinc chloride, rosin or ammonium chloride may be used satisfactorily. For zinc and galvanized materials, hydrochloric acid is a suitable flux.

It would be difficult to mention a flux that has not been recommended or tried for soldering aluminum. No soft soldering flux has yet been discovered that will allow the metal to be soldered with the same speed and reliability as can be attained in soldering iron, steel, brass, bronze, copper, nickel, etc., with ordinary commercial fluxes. It may be of interest to mention at this stage that a considerable number of tests of aluminum soldering processes and of the resulting joints carried out both at the Bureau of Standards, Washington, D. C. (Circular No. 78 on "Solders for Aluminum"), and the National Physical Laboratory, Teddington, Great Britain, have led to the conclusion that the use of fluxes in soldering aluminum is undesirable and that better results can be obtained without them.

Preparation of Zinc Chloride

The rapidity with which a soldering flux acts is an important factor in its usefulness. If the flux is in the form of a dry salt, a comparatively high heat is necessary to fuse it. If an aqueous solution is used, a certain amount of heat is essential

This comprehensive treatise on soldering practice is based on forty years' experience in joining metals by various soldering and brazing methods. Mr. Eyles, the author, during the last twenty-four years, has been foreman of the sheet-metal working departments of the London, Midland & Scottish Railway Co. He has recorded for the benefit of manufacturing industries many interesting, as well as essential, facts about the soldering art, including the selection of fluxes, the characteristics of different soft and hard solders, and the methods and principles that must be adhered to if strong joints are to be obtained by the use of soldering.

to evaporate the moisture. The function of a soldering flux is to dissolve the oxide, thereby keeping the metal surface clean and excluding the air. Zinc chloride has several properties which make it a valuable soldering flux, since it remains liquid at the temperature of molten solder, thus being in a condition to act readily upon the oxides. Sometimes it is recommended to add water to this flux, but in the writer's opinion this is detrimental because the stronger the flux can be made and still remain liquid, the better it will be. It is the zinc chloride that does the work. The water also has the disadvantage of causing spattering.

The flux is readily made by dissolving clean zinc (preferably in small pieces) in strong hydrochloric acid until the acid will not take up any more. The acid eats away the zinc, liberating hydrogen during the process. It is important to provide an excess of zinc so that a quantity remains undissolved after all chemical action ceases. The acid containers should be set outside the shop, so that the fumes will not rust or tarnish machine tools, etc., or be inhaled by workmen. After chemical action has ceased, it is best to allow the flux to stand for three or four hours before using, and it is advisable to filter the liquid through finely woven gauze.

Flux for Hard and Silver Soldering

The best and most reliable flux for hard and silver soldering is borax, as it dissolves any oxide that may exist on the surface of the metal and protects it from the air, thus allowing the solder to come into actual contact with the metal. Some mechanics simply crush the lump borax into a very fine powder and apply it to the areas or surfaces being joined. Others mix equal quantities of powdered borax and brazing solder together in clean water and apply the mixture to the joints. In the latter case, a little powdered borax is usually held in reserve to be thrown on the work, if necessary, in order to facilitate the fusing of the solder.

It is much better when using borax to have it calcined, since calcining prevents swelling and frothing as well as carrying away the brazing solder when the heat is first applied. Calcining may be done by applying an atmospheric gas blowpipe or gasoline blow-lamp flame upon the borax, when it will swell up. It can easily be rubbed down after it has cooled. Borax treated in this way is much easier to use.

How Soft Solders are Affected by Different Elements

Soft solders consist chiefly of lead and tin, although other metals are occasionally added to lower the melting point. The melting point of tin is 450 degrees F., and that of lead, 621 degrees F., yet when these two metals are alloyed in equal proportions to form ordinary solder (half and half) the melting point drops to about 370 degrees F., while a solder containing 66 per cent tin and 34 per cent lead, melts at about 350 degrees F.

A small quantity of antimony is frequently used in solders. This increases the tenacity and does not seriously affect the melting point or the working, except when present in appreciable quantities. Such solder requires more skill in its manipulation, and it is possible that the soldering coppers are more readily eaten away.

Zinc, even in very small quantities, has an injurious effect on soft solder, interfering with the soldering properties and dulling the surface. The solder flows sluggishly and leaves a very rough surface.

Bismuth melts at 505 degrees F., but an alloy of tin, lead, and bismuth will melt in boiling water (212 degrees F.). The writer has seen spoons made of this alloy melt when stirring very hot drinks. Bismuth possesses the property of expanding on cooling—a very unusual one in metals generally. It is, therefore, used not only to make a solder more easily worked by lowering its melting point, but if added in sufficient quantities, its expansive tendency counterbalances the effects of the contraction of the other metals. Metallic tin is used in some cases as a solder—for example, in soldering tin plate pipes and similar products.

What is the Strongest Soft Solder?

The question is frequently asked: What is the strongest soft solder that can be made? Numerous experiments have been made, but the results are rather confusing. Tests of tensile strength, based upon cast bars, sticks, and wires, indicate that the higher the tin, up to 73 per cent tin and 27 per cent lead, the greater the breaking strength. In the case of two pieces of tinned steel soldered together, the maximum strength is obtained with a solder containing about 60 per cent tin. Experience has shown the writer that the strongest mixture for general soldering purposes is a solder composed of 57 per cent tin and 43 per cent lead, particularly if 1/4 to 1/2 per cent of antimony is added to the mixture. For mechanical soldering, 45 per cent should be the highest tin content, and for most dipping bath work, it has been demonstrated that tin from 35 to 40 per cent, according to the nature of the work, will give ample satisfaction, provided the solder is properly made.

How to Make Soft Solders

When making soft solders, first melt the lead and scatter sufficient rosin in the melting pot to form a film to prevent oxidation. Then add the tin and stir the molten metal thoroughly with a piece of wood, carefully skimming off the dross from the surface. It should be remembered that solder dross contains a higher percentage of tin than the solder, owing to the fact that tin oxidizes more rapidly

---

What Is Contributory Patent Infringement?

Few people are thoroughly informed on what is meant by contributory infringement of a patent. Such infringement consists of any act that ultimately may result in an infringement of a patent. Furthermore, any person who makes, sells, or uses even one part of a patented device may be held liable, provided the part is specifically covered by the claims of the patent. On the other hand, no one is liable for infringement if the part made, sold, or used is not specifically covered by the claims. Many phases of contributory infringement are clearly presented in the article "What is Contributory Infringement of Patents?" which will be published in May MACHINERY. A large number of interesting cases are cited to illustrate important points.

---

than lead when in a molten state. Hence, great care should be taken in melting any soft solder composition containing tin, to avoid overheating, because it is not only detrimental to the solder, but also causes waste of tin through excessive production of oxide.

If the solder is to be used in one's own plant, or if thin strips or sticks are ordered without specifying certain shapes, the solder may easily be produced in these forms without the use of special molds. For example, a piece of angle-iron or corrugated iron is often used; also, wood and sand molds are sometimes used, but the two latter are not recommended. Wood soon becomes charred and the metal alloy cools very slowly. In using sand molds, particles of sand are likely to get into the solder, which is detrimental to the solder. A useful type of mold for making solder is made of sheet steel, 1/16 inch thick, bent to form a series of V-shaped angles, with ends to prevent the solder from running out. Another good solder mold is made of cast iron with V-shaped grooves.

Testing Soft Solder

To test solder, run a strip or stick of the molten mixture into the mold or on an iron plate, so as to allow the solder to cool quickly. Should it turn a bluish gray, it is coarse, containing a high percentage of lead; if a dull white and pitted with grayish white spots, it contains a high percentage of tin. In either instance, the remedy is obvious. Another test is to bend a bar or stick of the solder; if it emits a slight crackling noise, it is of good quality, but should the crackling noise be excessive, a little lead should be added. Zinc, aluminum, and copper are detrimental to soft solders (tin-lead alloys). These elements impair the soldering properties and cause the solder to flow sluggishly and leave a rough surface.

Hard or Brazing Solders

There are three methods of brazing, depending on the size of the work. These are dip, torch, and open furnace brazing. In order fully to appreciate what is actually required of a hard or brazing solder, it should be understood that the nature of the work invariably should determine the approximate fusing point of the brazing solder to be employed. The fusing point of the brazing solder should, of course, be below that of the material to be brazed; but not too much below it, if the strength of the joint is an important consideration. A hard solder which would be quite suitable for the various brasses, would be unsuitable for iron or steel. Conversely, it might prove disastrous to attempt to use on ordinary brass a hard solder which would be ideal for making joints in iron or steel.

In making hard and brazing solders, it is desirable that the constituent metals (copper, zinc, etc.) be commercially pure, as impurities interfere with the color, malleability, and strength of the solder. These alloys should be free from antimony, aluminum, arsenic, lead, and tin, as they are injurious elements to employ where great strength is necessary. Brazing solders are usually purchased in a granulated form, so as to facilitate ease and celerity in melting. The usual sizes made are 00, 0, 1, 2, 3, 4, and 5, the 00 size being exceedingly fine and generally used with an atmospheric gas blowpipe or gasoline torch flame. When the copper content exceeds 60 per cent, the brazing solder is usually supplied in strip material. The accompanying table gives the composition of various hard solders for different metals.

Coated metals, such as galvanized iron, tinned steel, or nickel-, cadmium-, or chromium-plated products cannot be brazed without destroying the coating or plating in the process. Nor can the comparatively soft metals, such as aluminum, lead, tin, and zinc be brazed, since their respective melting points are below the melting point of brazing solder. Strictly speaking, brazing methods should not be attempted on metals whose melting point is less than that of soft brass. Metals, such as uncoated iron, steel, brass, bronze, copper, monel metal, stainless steel, etc., can be brazed easily.

It should be remembered that the greater the percentage of copper in a brazing solder, the higher the melting point. If a specially low melting point be required, a little silver should be added to the formula given for soft brass. In any case, the melting point of a given brazing solder should always be lower than the melting point of the metal or metals to be brazed.

Hard or Brazing Solders

Metal to be Brazed	Approximate Composition, Per Cent			Melting Temp.	
	Copper	Zinc	Silver	Deg. C.	Deg. F.
Iron and steel	66	34	..	918	1684
Monel metal..	63	37	..	908	1666
Copper.......	60	40	..	890	1634
Brass, hard..	50	50	..	880	1616
Brass, soft...	33	67	..	803	1477
Silver.......	25	15	60	...	....

Machinery

Experience has shown the writer that the process of hard or silver soldering can be applied with equal success to brass, copper, monel metal, nickel, iron, mild steel, modern stainless steels, etc. With reasonable care, a close, neat joint results, the strength and reliability of which is remarkable, and exceeds that obtained by either brazing or soft soldering. Unfortunately, many engineering establishments associate high cost with the name of silver solder; but owing to the careful and sparing way in which it is used, and the small amount of finishing which the joints require, it is not unduly expensive. In fact, silver solder is one of the cheapest jointing materials to employ for many kinds of automotive and general engineering work. The advantage of silver solder lies in the freedom with which it will melt and flow into the joints. While silver solder is not so fusible as the soft solders, it is intermediate between them and the brazing solders.

Silver solders are made in strip, sheet, and granular form, and in a number of different grades of fusibility. The melting points of silver solders vary between 1250 and 1500 degrees F. One of the best silver solders used is made of 61 per cent silver, 29 per cent copper, and 10 per cent zinc. Many alloys of low silver content are used, in which the silver ranges from 5 to 50 per cent. Silver solder is especially suitable for jointing monel metal, nickel, and stainless steel, since it gives the necessary whiteness to the seam or joint, whereas with

ordinary brazing solder, a red or yellow color is noticeable at the joint.

For successful silver soldering, it is essential that the parts be maintained throughout the operation in close, firm contact. This insures the ready flow of the solder, and results in a neat and exceedingly strong joint. Silver soldering is usually done by means of an air-acetylene blowpipe, or atmospheric gas blowpipe, and powdered borax is generally used as a flux. Borax, in paste form, is the cleanest and most convenient flux. The paste is produced by moistening the borax in clean water. The flux can be applied to the parts to be jointed with a small brush.

The work should be heated gradually at first, so as to harden the borax flux; then heating should be continued with a clean flame until a red heat is reached, at which temperature the solder will run and penetrate interstices which ordinary hard solders would fail to fill. As soon as the joint has been completed, the source of heat should be removed and the work quickly plunged in clean cold water. This method of procedure disintegrates the flux and scale, which if left to cool slowly, would set in a very hard vitreous film that is extremely difficult to remove.

Soldering Tools

Soldering coppers of different sizes and shapes, suitable for different kinds of work, should be included in every shop equipment. A small soldering copper, for example, should not be used on heavy metal products, as it cannot contain sufficient heat to allow the solder to flow and sweat into the joint. When the small copper is applied to the metal surface, it becomes cool quickly, with the result that the workman wastes much time in trying to keep the coppers hot, or in soldering with relatively cold tools, which means poor work.

After selecting soldering coppers of suitable weight for the work in hand, the next point to consider is the required shape. These tools can be forged to any desired shape by placing the copper in a clean bright fire and heating it to a dark cherry color. Forged soldering coppers are better heat retainers than soldering tools cast from ingots. Scale formed during the heating process should be removed by filing with a partly worn file and forging the copper on an anvil or suitable iron block by hammering. The shank of the soldering tool should not be of too great length, as it is likely to fatigue the arm of the user quickly. For general soldering work, the soldering tool should be about 15 inches long from the point to the extremity of the handle.

Tinning Soldering Tool

Before a soldering tool can be used effectively, it must be tinned. That is, the points or slopes must be coated with a tin-lead alloy. When tinning pointed or ordinary soldering tools, they should be heated to a dull red color, then filed bright on four sides, not higher than 1 inch from the point. This gives a bright, smooth surface, ready for tinning. If the copper is sufficiently hot, the filed areas should be rubbed briskly on a solid sal-ammoniac block, and a small portion of solder melted into a cavity in the central area of the block; by rubbing the copper to and fro or rotating it briskly, it will quickly become tinned.

Keeping the tinned areas of the copper bright and clean is of the greatest importance in soldering. It should be the aim of the user to see that the soldering tool is never raised to a red heat sufficient to melt the tinning, because retinning involves loss of time and filing new faces quickly wears away the copper.

Methods of Heating Soldering Tools

Although soldering coppers may be heated in any fire, it is much better to avoid the dirt, smoke, and tarry substances often present in a coal fire. Various soldering furnaces, such as electric, gas, oil and charcoal, are often employed in railroad and automobile construction and repair shops. Modern gas furnaces are fitted with an automatic cut-off arrangement, which automatically reduces the gas flame to a pin-point when the soldering tool is withdrawn from the furnace. Of late years, several varieties of soldering tools, heated by gas, electricity, acetylene, and gasoline, have come largely into use.

With an electrically heated soldering tool, there is no necessity for having a large copper for heat storing purposes, since the heat is supplied internally and continuously by the electric current. Care must be taken in using electrically heated soldering tools, as they will not stand the rough usage generally given to ordinary soldering coppers. An important advantage with these modern soldering tools is that only one tool is necessary for soldering operations, whereas it generally requires two ordinary soldering tools (one being heated while the other is being used) to avoid loss of time.

Modern electric furnaces for heating soldering coppers are fitted with a special tipping motion and cut-out, whereby the current is kept at the minimum, being automatically controlled according to the number of soldering tools under heat. With the switch on, the muffle is kept warm, the insertion of one or more soldering coppers automatically turning on the requisite amount of energy to give rapid heating. The withdrawal of the soldering coppers proportionately reduces the power. By this method of heating, the soldering tools are maintained in a better condition and for longer periods, owing to the absence of gases which attack the copper and result in pitting.

The advantages of the modern electric furnace are: (1) No fumes in the work-shop; (2) rapid

---

Extrusion of Aluminum Tubes

For many years efforts have been made to substitute aluminum for tin in the making of collapsible tubes. Extensive experiments have been made, and at the present time, aluminum collapsible tubes are successfully made. In an article in May MACHINERY Robert Valverde will outline the methods used in this new development and point out the difficulties met with and how they have been overcome. Mechanical men who wish to be informed on new developments in the field will find much of interest in this article. The millions of extruded tubes that are now used annually for a great many purposes lend interest to the methods by which twenty-two tubes a minute are extruded on one machine.

---

and uniform heating; (3) no pitting of the soldering coppers from gas fumes; and (4) safety in operation. In conclusion, there are a few points that should be kept in mind during the processes of soldering and brazing as given in the following.

Points to be Considered in Soldering and Brazing

1. Scrupulous cleanliness in everything connected with the process of soldering is essential to success. Solders adhere tenaciously only to bright and clean surfaces.

2. Don't use one kind or brand of flux for all metals, as the flux selected should be determined by the nature of the work; for example, if brass, copper, monel metal, or tinned steel is to be soldered, zinc chloride is best; for zinc or galvanized iron or steel, use hydrochloric acid; and for lead, tallow or rosin. Aluminum and its alloys require no flux when soldering.

3. Soldering fluxes may, in general, be divided into two classes—corrosive and non-corrosive. The corrosive fluxes are the acid fluxes. The non-corrosive fluxes, of which rosin and tallow are examples, are those that do not react chemically with copper or brass.

4. Don't use zinc chloride alone when soldering electrical apparatus, as it is corrosive. Rosin, either as a powder or an alcoholic solution, is a splendid flux for soldering operations on electrical conductors, since it is free from acid.

5. Don't fail to clean the work thoroughly after soldering when zinc chloride or hydrochloric acid is used, so as to prevent subsequent corrosion.

6. The soldering of aluminum must be performed quickly to get the best results.

7. Tinning the surfaces of aluminum, brass, copper, and monel metal preparatory to soldering is an important operation.

8. Solders should not be stored in a damp atmosphere. If kept for some time, the solder deteriorates; hence, when required for use, the alloy does not flow so readily.

9. The heating of fairly large parts to be soldered and raising them to the correct fusing temperature is essential to success in soldering metal parts and aluminum castings.

10. The essentials of a good brazed or hard soldered joint are the contact of absolutely clean surfaces free from oxide and dirt. The surfaces should be cleaned by filing, grinding, chipping or scraping, and if the work is greasy, it should be thoroughly washed in a strong solution of hot soda water.

11. Don't attempt to braze or silver-solder aluminum, as the metal is far more likely to fuse than many of the brazing and silver solders employed. Acetylene welding methods are the most reliable for aluminum.

12. Don't fail to fasten the parts together in the position they are to occupy when silver-soldered or brazed. The fastening can be effected, in most cases, by the use of clamps, wires, bolts, etc.

13. In brazing iron or steel, there is no danger of melting these metals with the atmospheric blowpipe flame. Hence, a hard solder having a comparatively high fusing point can be employed.

14. Electric hard soldering or brazing differs from ordinary methods in that the heat is generated in the metal itself by reason of its resistance to a low-voltage current. Hence, it somewhat resembles electric welding, although in the latter process, a higher temperature is used—sufficient actually to fuse the metal—and no flux or solder is added.

15. Any metal or alloy can be electrically soldered that can be soldered by other means, as it is usually, apart from the jigs and fixtures, only a question of current regulation.

16. In ordering brazing or silver solder, it is always best to specify its composition or the purpose for which it is to be used.

17. In brazing the longitudinal seam of a sheet-metal tube, it is advisable to let one edge of the metal overlap the other, and, if possible, it should be dovetailed. Great care should be taken not to burn the metal by letting it become too hot.

18. Prolonged heating when brazing copper, brass, or monel metal must be avoided as much as possible, because it tends to oxidize and weaken the brazing material and the metal being brazed.

19. Excessive use of flux, especially toward the completion of the brazing operations, will result in a very hard surface which will be extremely difficult to finish properly.

20. Experience proves that many joints appear sound, but when the superfluous solder is removed, it is discovered that this is what held the pieces together, as the solder has not entered the joint.

21. Don't forget that rapidity is the keynote in all successful silver soldering and brazing operations, as no time whatever must be lost during the processes.

* * *

SPACING HOLES IN A CIRCLE

By W. S. DAVENPORT, President and General Manager,
Davenport Machine Tool Co., Rochester, N. Y.

The writer read with considerable interest the article in February MACHINERY, page 456, entitled "Novel Drill Jig for Spacing Holes on Circle." In January last year the writer planned a jig made on a similar principle with five holes. It is obvious that this method will make perfect spacing if the work is carefully done. All the mathematics necessary is to obtain the length of the chord from the center of one hole to the center of the next, which is easily done by the aid of any handbook.

The writer does not claim originality for this method, as he believes he saw it outlined in connection with other methods for dividing circles ten or fifteen years ago. The method is not limited to a small number of holes, but could be used for subdividing a circle into a great many spaces. It requires a high degree of workmanship, however, to make the parts exactly of the right diameter. Probably no more accurate method for making equally spaced holes—four, five, six, or any number up to ten—was ever devised.

* * *

A new type of locomotive has recently been tested in freight service in Germany. Externally this engine does not differ materially from the conventional type, except that the tender is completely enclosed and carries a boiler-like container filled with powdered coal. It is stated that the tests made with this engine have been very successful.

Three-spindle Tap-fluting Fixture

By O. S. MARSHALL

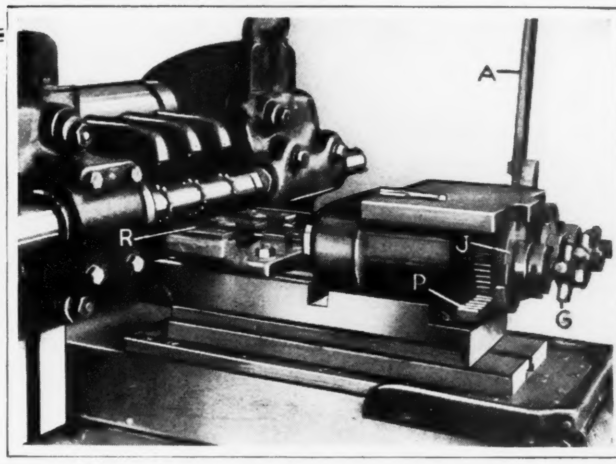


Fig. 1. Three-spindle Tap-fluting Fixture

THE triple indexing fixture shown in Fig. 1 has proved very efficient for gang-milling the flutes of taps on a production basis. It is designed for use in the familiar Lincoln type automatic milling machine. The rack and pinion mechanism for indexing the three pieces of work simultaneously is actuated by the conveniently located lever *A*. Interchangeable index-plates *J* for cutting three, four, or six flutes are provided. The threaded ends of the three taps are supported on centers, while the shank ends are gripped by the square-jaw draw-in collets operated from the rear of the fixture by handles *G*.

A cross-section view of the indexing mechanism is shown in Fig. 2, in which the same reference letters are used as in the detail views, Fig. 3. The main casting *U*, Fig. 2, has an adjustable center-carrying block *B* and a top plate *C*. Three collet spindles *D* are fitted in the accurately bored holes in the main casting. The collets *E* are made in different sizes to suit the various taps to be fluted and are screwed on the connecting-rods *F*. The work is held against the center by the control rod, which advances when turned by the handle *G*, until the pressure against the work draws the split collet back against the tapered seat of the spindle, causing the collet to close upon the work. This square-jaw grip on the work insures positive rotation when indexing.

Each spindle is fitted with a gear *H*, releasing plate *I*, locking or indexing plate *J*, and a locking bar *K*. Bar *K* is forced into the locking notch by a spring *L* when the indexing movement of lever *A*, Fig. 1, brings the slot into position. The shape of the locking bar *K* is shown by the plan and side views in the upper right-hand corner of Fig. 2. The 45-degree face at *a* is engaged by the releasing plate *I* at the beginning of the indexing movement. As the releasing plate is rotated, the contacting angular surfaces cause the locking bar to be forced out of the slot in the indexing plate. The 15-degree slope *b* at the end of the locking bar is provided to take up backlash.

Gear *H* and releasing plate *I* are free on the work-spindle, while indexing plate *J* is keyed to the spindle. Gear *H* has two square keyways, spaced 180 degrees apart, in which spring-actuated ratchet pawls *N* are located. One pawl engages the release plate *I*, and the other, the indexing plate *J*. These opposite or right- and left-hand pawls engage pins *O*, four of which are firmly seated in the index plate *J* and three in the release plate *I*. These pins are equally spaced in their respective plates.

Details of the plates, ratchet pawls, and pins are shown in Fig. 3, where each part bears the same reference letter as in Figs. 1 and 2. The pins and pawls are so positioned that when one pair is in engagement or contact, the opposite pair slides out of engagement. The proper timing of the disengaging action of the plate lock, which occurs dur-

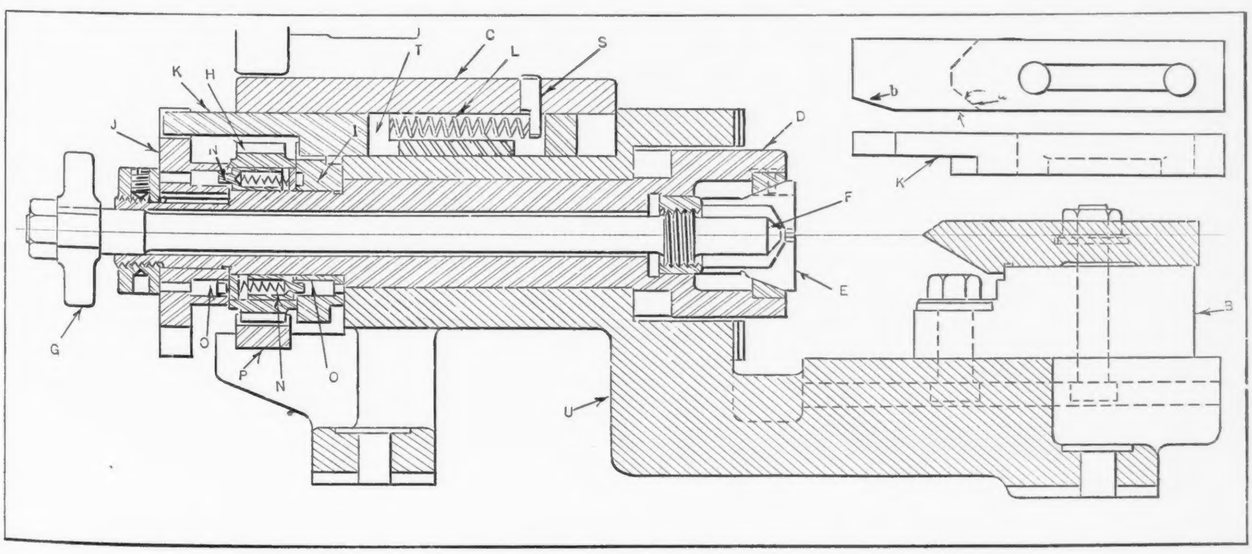


Fig. 2. Cross-section of Indexing Tap-fluting Fixture Shown in Fig. 1

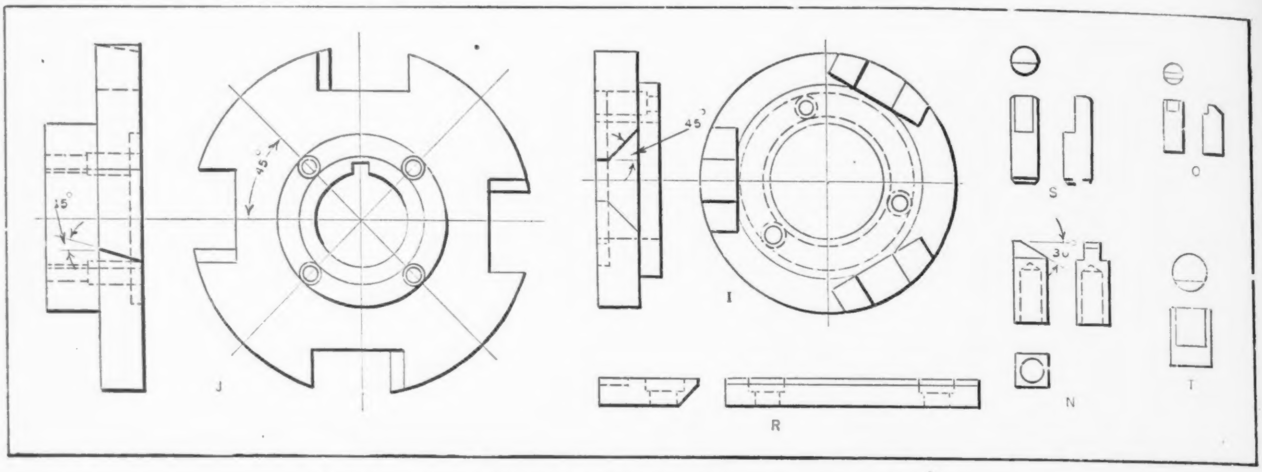


Fig. 3. Some of the Parts of Fixture Shown in Figs. 1 and 2

ing the upward swing of the hand-lever *A*, Fig. 1, is obtained by having four engaging points in the indexing plate and three in the releasing plate. With the downward motion of the lever, the indexing plate pawl slides into engagement and causes the work-spindle to rotate.

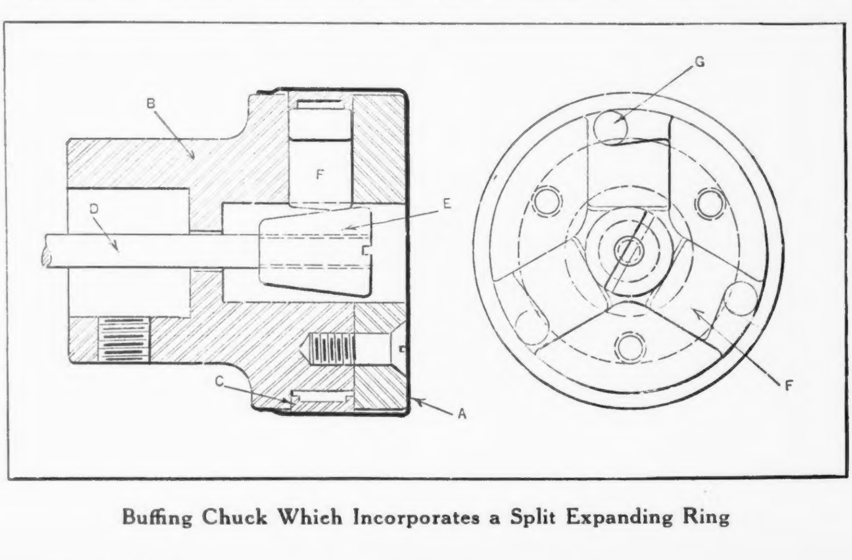
A rack *P*, which meshes with the second and third spindle gears, but not with the first gear, causes the three work-spindles to be rotated simultaneously when the hand-lever *A* is operated. There is a separate spur gear on the shaft that carries lever *A*, and this gear engages the gear on the first spindle and also the rack *P*. The first spindle gear has a smaller pitch diameter than the gears on the second and third spindles, and thus clears the rack *P*. This arrangement provides for rotating all three work-spindles in the same direction. Hardened abutment plates located in gears *H* back up the pawl springs.

* * *

BUFFING CHUCK WITH EXPANDING RING

Cup-shaped sheet-metal parts having a reduced diameter at the open end are being buffed on the type K machines built by the Automatic Buffing Machine Co., Buffalo, N. Y., by the use of chucks designed as shown in the accompanying illustration. The work is illustrated at *A* in place on the chuck, ready to be buffed.

For holding the part securely during the operation, this chuck is provided with a split spring steel ring *C* which is automatically expanded after the work has been slipped on the chuck. This expansion is accomplished as rod *D* pulls the tapered collar *E* toward the left so as to move three blocks *F* radially outward. The shape of the outer end of blocks *F* is such as to push three rollers *G* firmly against ring *C* and thus expand this ring against the work. Since the chuck revolves in a clockwise direction, looking at the front end, pins *G* have a tendency to wedge more tightly against the expanding ring as the polishing or buffing wheel is applied to the work. By merely reversing the assembly of blocks *F*, the chuck is arranged for rotation in a counter-clockwise direction. Rod *D* is operated automatically.



Buffing Chuck Which Incorporates a Split Expanding Ring

* * *

FALK APPRENTICES RECEIVE AWARDS

At a dinner recently given by the Apprentice Association of the Falk Corporation, Milwaukee, Wis., which was attended by the members of the association (numbering about 120 apprentices) as well as practically all the shop executives and foremen of the company and several of the general executives, prizes were awarded to more than a dozen apprentices for excellence in their work. The prizes consisted of checks ranging from $22 to $72, to be applied to the purchase of tools or drafting instruments. In addition, each prize winner was given a year's subscription to a leading mechanical journal. In awarding these prizes, the following factors were taken into account: Workmanship, record in school work (the apprentices attending a continuation school where vocational subjects are taught), deportment, attendance, and punctuality.

* * *

Awards amounting to $51,567 have been made by the General Electric Co. to 4913 of the company's employes who made suggestions for improvements in working conditions or for the increasing of the efficiency of the company's operations during 1927. These suggestions were offered under the suggestion plan which has been in effect in this company's plants for many years. In 1927 over 15,000 suggestions were offered, of which about one-third were accepted.

MACHINERY'S DATA SHEETS 127 and 128

TENTATIVE AMERICAN STANDARD NUTS—1

ROUGH AND SEMI-FINISHED SQUARE AND HEXAGONAL REGULAR NUTS

Diameter of Bolt		Width Across Flats, Maximum		Width Across Flats, Minimum	Minimum Width Across Corners, Hex.	Minimum Width Across Corners, Square	Thickness, Nominal	Thickness, Maximum	Thickness, Minimum
1/4	0.2500	7/16	0.4375	0.425	0.485	0.584	7/32	0.235	0.203
5/16	0.3125	9/16	0.5625	0.547	0.624	0.751	17/64	0.283	0.249
3/8	0.3750	5/8	0.6250	0.606	0.691	0.832	21/64	0.346	0.310
7/16	0.4375	3/4	0.7500	0.728	0.830	1.000	3/8	0.394	0.356
1/2	0.5000	13/16	0.8125	0.788	0.898	1.082	7/16	0.458	0.418
9/16	0.5625	7/8	0.8750	0.847	0.966	1.163	31/64	0.505	0.463
5/8	0.6250	15/16	0.9375	0.906	1.033	1.244	35/64	0.569	0.525
3/4	0.7500	1 1/8	1.1250	1.088	1.240	1.494	21/32	0.680	0.632
7/8	0.8750	1 5/16	1.3125	1.269	1.447	1.742	49/64	0.792	0.740
1	1.0000	1 1/2	1.5000	1.450	1.653	1.991	7/8	0.903	0.847
1 1/8	1.1250	1 11/16	1.6875	1.631	1.859	2.239	1	1.030	0.970
1 1/4	1.2500	1 7/8	1.8750	1.813	2.067	2.489	1 3/32	1.126	1.062
1 1/2	1.5000	2 1/4	2.2500	2.175	2.480	2.986	1 5/16	1.349	1.277
1 3/4	1.7500	2 5/8	2.6250	2.538	2.893	3.485	1 17/32	1.571	1.491
2	2.0000	3	3.0000	2.900	3.306	3.982	1 3/4	1.794	1.706
2 1/4	2.2500	3 3/8	3.3750	3.263	3.720	4.480	1 31/32	2.017	1.921
2 1/2	2.5000	3 3/4	3.7500	3.625	4.133	4.977	2 3/16	2.240	2.136
2 3/4	2.7500	4 1/8	4.1250	3.988	4.546	5.476	2 13/32	2.350	2.462
3	3.0000	4 1/2	4.5000	4.350	4.959	5.973	2 5/8	2.685	2.565

Formulas

All dimensions given in inches.

Width across flats of rough and semi-finished regular nuts shall be 1 1/4D (D = diameter of bolt) except as follows:

Diameter of Bolt	Width Across Flats
1/4 to 9/16	1 1/2D + 1/16

with adjustment in the sixteenth inch sizes to eliminate thirty-second inch size wrench openings.

Tolerance for width across flats shall be minus 0.050D.

Minimum width across rounded corners of hexagon equals 1.14 times minimum width across flats.

Minimum width across rounded corners of square equals 1.373 times minimum width across flats.

Thickness for rough and semi-finished regular nuts shall be 7/8D.

Tolerance for thickness shall be 0.032D + 0.024.

The top of rough and semi-finished regular square and hexagonal nuts shall be flat and chamfered; angle of chamfer with surface shall be 30 degrees; diameter of top, or of both top and bottom circle, shall be 100 per cent of the nominal width across flats.

Tolerance on diameter of top flat circle shall be minus 15 per cent.

Semi-finished nuts shall be faced on bearing surface and at right angles to the axis of the thread within 3 degrees.

Width across flats to be measured at the top of the nut.

Taper of sides of nuts shall not exceed 4 degrees.

MACHINERY'S Data Sheet No. 127, New Series, April, 1928

TENTATIVE AMERICAN STANDARD NUTS—2

FINISHED SQUARE AND HEXAGONAL REGULAR NUTS

Diameter of Bolt (All dimensions in inches)		Width Across Flats, Maximum		Width Across Flats, Minimum	Minimum Width Across Corners, Hex.	Minimum Width Across Corners, Square	Thickness, Nominal	Thickness, Maximum	Thickness, Minimum
1/4	0.2500	7/16	0.4375	0.428	0.488	0.588	7/32	0.225	0.212
5/16	0.3125	9/16	0.5625	0.552	0.629	0.758	17/64	0.273	0.258
3/8	0.3750	5/8	0.6250	0.613	0.699	0.842	21/64	0.336	0.320
7/16	0.4375	3/4	0.7500	0.737	0.840	1.012	3/8	0.384	0.366
1/2	0.5000	13/16	0.8125	0.799	0.911	1.097	7/16	0.448	0.428
9/16	0.5625	7/8	0.8750	0.861	0.981	1.182	31/64	0.495	0.473
5/8	0.6250	15/16	0.9375	0.922	1.051	1.266	35/64	0.559	0.535
3/4	0.7500	1 1/8	1.1250	1.108	1.263	1.521	21/32	0.670	0.642
7/8	0.8750	1 5/16	1.3125	1.293	1.474	1.775	49/64	0.781	0.750
1	1.0000	1 1/2	1.5000	1.479	1.686	2.031	7/8	0.893	0.858
1 1/8	1.1250	1 11/16	1.6875	1.665	1.898	2.286	1	1.019	0.981
1 1/4	1.2500	1 7/8	1.8750	1.850	2.109	2.540	1 3/32	1.115	1.072
1 1/2	1.5000	2 1/4	2.2500	2.222	2.533	3.051	1 5/16	1.338	1.288
1 3/4	1.7500	2 5/8	2.6250	2.593	2.956	3.560	1 17/32	1.560	1.503
2	2.0000	3	3.0000	2.964	3.379	4.070	1 3/4	1.783	1.718
2 1/4	2.2500	3 3/8	3.3750	3.335	3.802	4.579	1 31/32	2.005	1.932
2 1/2	2.5000	3 3/4	3.7500	3.707	4.226	5.090	2 3/16	2.228	2.148
2 3/4	2.7500	4 1/8	4.1250	4.078	4.649	5.599	2 13/32	2.450	2.363
3	3.0000	4 1/2	4.5000	4.449	5.072	6.108	2 5/8	2.673	2.578

Formulas

Width across flats of finished hexagonal and square regular nuts shall be 1 1/2D (D = diameter of bolt) except as follows:

1/4 to 9/16 = 1 1/2D + 1/16

with adjustment in the sixteenth inch sizes to eliminate thirty-second inch size wrench openings.

Tolerance for width across flats shall be minus (0.015D + 0.006).

Minimum width across corners of hexagon equals 1.14 times minimum width across flats.

Minimum width across rounded corners of square equals 1.373 times minimum width across flats.

Thickness of finished regular nuts shall be 7/8D.

Tolerance for thickness shall be 0.030D + 0.005.

The top of finished nuts shall be flat and chamfered; angle of chamfer with surface shall be 30 degrees; diameter of top circle shall be 100 per cent of the nominal width across flats.

Tolerance on diameter of top flat circle shall be minus 15 per cent.

All finished hexagon and square regular nuts shall be washer faced; the thickness of the washer face shall be 1/64 inch. The thickness of the nut shall be the distance from the top of the nut to the bearing surface. The bearing surface of the washer face shall be 100 per cent of the nominal width across flats. Tolerance on the diameter of the washer face shall be plus or minus 5 per cent.

The axis of the threaded hole shall be at right angles to the washer face within a tolerance of 2 degrees.

MACHINERY'S Data Sheet No. 128, New Series, April, 1928

Milling Arcs of Large Radii

By E. VINCENT ERICKSON

VERY often in the jobbing shop there are problems that must not only be solved, but solved in such a way as to be compatible with the time and equipment available. Cutting an arc of large radius with a milling cutter of ordinary dimensions is an example. By the method to be described little trouble is experienced in the performance of this task, but the preliminary computations are difficult and also subject to misleading errors.

The basis for this method lies in the fact that portions of the perimeter of an ellipse approximate very closely the arc of a circle. If a milling cutter is fed into the work at right angles to its axis of rotation, a plane surface will be cut. Likewise, if it be fed into the work in a direction parallel to its axis, the arc of a circle will be cut, having a radius equal to that of the cutter. If, however, the work and the cutter assume some intermediate position, the arc of an ellipse will be cut. It can be shown that a definite relation exists between this intermediate position and the radius of a portion of the perimeter of the ellipse. With this in view, the following equation has been worked out to give the required angle.

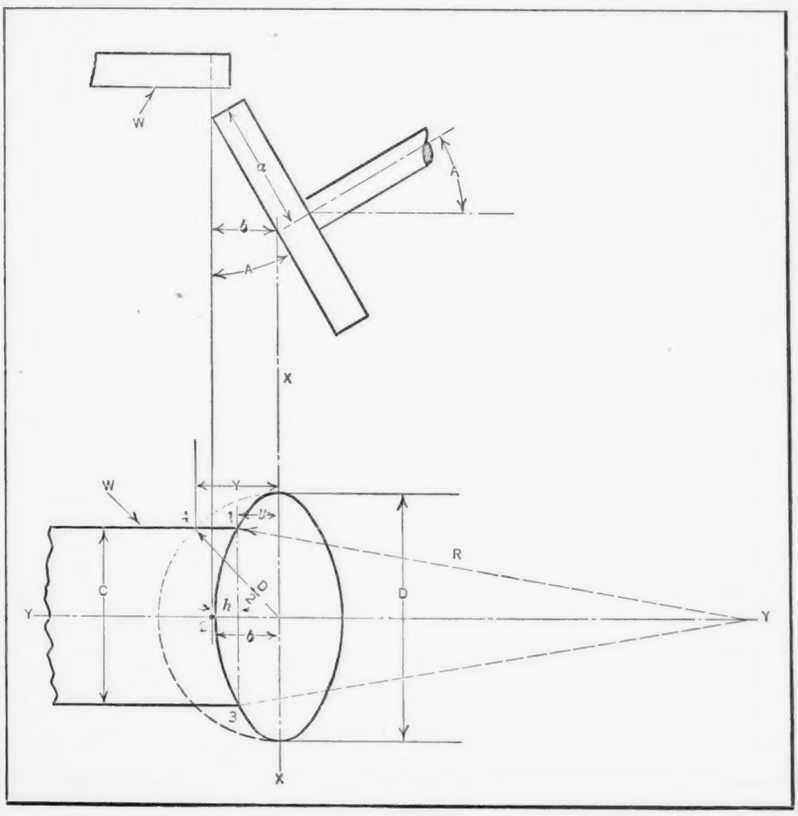


Diagram Showing how Arc of Large Radii is Milled by Inclining Cutter

Suppose it be necessary to cut a surface of radius R (see illustration) in the piece W, with a cutter having a diameter D. The width of the piece should not be more than three-quarters of the cutter diameter, or the error involved is too great. The true curve will be the arc of a circle passing through points 1, 2, and 3. An ellipse can be passed through these three points which will deviate, at any other point, only slightly from the desired curve. Assume that

A = angle between plane of rotation of cutter and line of feeding movement of work;
R = radius to be cut, in inches;
C = width of piece W, in inches; and
D = diameter of cutter, in inches.

Then angle A may be determined by the formula,

$$\text{Sine } A = \frac{2R - \sqrt{4R^2 - C^2}}{D - \sqrt{D^2 - C^2}}$$

This equation was derived in the following manner: From analytic geometry, the general equation of the ellipse is $a^2y^2 + b^2x^2 = a^2b^2$, and for the circle, $X^2 + Y^2 = a^2$. In these formulas,

a = semi-major axis of ellipse = radius of cutter;
x and y = coordinates of any point on the ellipse, referred to rectangular axes;
b = semi-minor axis of ellipse; and
X and Y = coordinates of any point on the circle, referred to the same axes.

Let the X and Y axes be chosen as in the illustration. Describe a semicircle on the diameter of the cutter, which is equivalent to revolving the cutter in the plane of the paper. Now if the two foregoing equations are applied to the points 1 and 4 of the ellipse and circle, respectively, we see that $x = X$. By solving the equations simultaneously, we obtain the relation

$$\frac{y}{Y} = \frac{b}{a} = \text{sine } A$$

$$y = b - h \text{ and } h = R - \sqrt{[R^2 - \frac{C^2}{4}}$$

$$y = b - R + 0.5\sqrt{4R^2 - C^2}$$

$$\text{Sine } A = \frac{b}{a} = \frac{b}{0.5D} \text{ and } b = 0.5D \text{ sine } A$$

$$y = 0.5D \text{ sine } A - R + 0.5\sqrt{4R^2 - C^2}$$

$$Y = 0.5\sqrt{D^2 - C^2}$$

$$\text{Sine } A = \frac{0.5D \text{ sine } A - R + 0.5\sqrt{4R^2 - C^2}}{0.5\sqrt{D^2 - C^2}}$$

Solving for sine A,

$$\text{Sine } A = \frac{2R - \sqrt{4R^2 - C^2}}{D - \sqrt{D^2 - C^2}}$$ which is the desired formula.

Current Editorial Comment

In the Machine-building and Kindred Industries

INSPECTION MUST KEEP PACE WITH PRODUCTION

Machines and tools for producing work at speeds that only ten years ago were considered impossible are available to any manufacturer whose production is great enough to warrant their installation; but the development of inspection devices and methods has not kept pace with that of production machinery. When a machine is installed that produces two or three times as much as the equipment formerly used—one operator performing the work for which two or three were previously needed—the inspection methods usually remain the same. The problem of inspecting the increased production is generally met by employing two or three inspectors instead of one.

It is possible with specially designed inspection devices, to speed up the work of inspecting the product. Production engineers who have solved their machining problems should now devise means for rapid inspection. In some plants, highly efficient devices for this purpose have been installed, but their use is not general, and the next few years will see a great improvement in inspection methods. Fixtures using dial gages, for example, insure great rapidity in measuring. Sometimes these are so designed that two or more dimensions are measured at once, several dial gages being mounted on the same fixture. Progress is certain along these lines and will reduce manufacturing costs.

* * *

HINTS ON MARKING SHIPMENTS

Machinery manufacturers who are not familiar with export business do not realize the delay in forwarding, and sometimes the complete loss of shipments, resulting from unsatisfactory marking. Careful marking, especially of export shipments, is therefore of great importance.

When a shipment contains a number of crates or boxes, each one should be consecutively numbered as a part of the complete shipment. In Brazil and other countries the receiver of the shipment is subject to a fine if the shipment is not properly numbered in this manner.

The stencil marking used by many American exporters is too small. Even large crates and cases are frequently marked with stencils only one inch high, whereas foreign shipments whenever possible should be marked with letters from three to five inches high; and two inches should be the minimum height, even on small boxes. All lettering should be stencilled, because brush marking, besides being prohibited in some countries, is seldom as clear as stencil marking.

The complete address and other marking should be placed on at least two faces of the crate or box. All marking must agree in every detail with the statement shown on invoices and bills of lading. Everything pertaining to the address and marking should be in one place on the crate or box, and the name of consignee, destination, and route should be at about the center of the side on which the marking is placed.

The best means for marking is a black waterproof stencil ink or paint, covered with a coating of shellac, which prevents dampness, water, or rubbing from damaging the marking.

Drawings Not Common Property

Manufacturers of machine tools and cutting tools sometimes find that their customers consider that blueprints submitted to them in connection with bids are common property. They use the ideas furnished by one manufacturer when they place the order with another, or make the tool or appliance in their own shop. Some buyers of equipment have gone so far as to require a set of drawings with every machine and tool bought by them, and in some cases these drawings have been used for making additional machines and tools, either in the buyer's own shop or in some contract shop to which the work has been let. Drawings and the ideas embodied therein, belong to the manufacturer who furnishes the original design, and whether protected by patents or not, are his property and should not be used for purposes detrimental to him.

* * *

AN UNRELIABLE BUSINESS BAROMETER

An official of a large steel company suggests that unfilled steel orders are no longer a reliable barometer of business in the metal-working industries. Years ago, when the tonnage of unfilled orders for steel mounted, it was taken to be an indication of good business prospects. A small tonnage of unfilled orders was considered a fairly accurate sign of coming depression in business.

In recent years unfilled orders on the books of the steel companies at the end of each month have been comparatively small, yet the total sales of steel have been large, and industrial activity in general has continued at a relatively high level. Unfilled orders are no longer proportional to the general industrial activity, because orders are now given for almost immediate deliveries and shipments are made more promptly than formerly. The shipments during the month may run into large figures, while the actual orders on the books of the steel companies at the end of the month may be comparatively small.

As a barometer of business conditions, the unfilled orders are no longer an accurate indication. It is more satisfactory to note the tonnage of steel produced over a number of months, as this is a more accurate indication of the outlook in the industries that use steel.

The Modern Trend of Apprentice Training

By HAROLD S. FALK, Vice-president and Works Manager, The Falk Corporation, Milwaukee, Wis.

WHEREVER industrial men gather, complaints are heard about the inefficiency of labor, high labor turnover, and industrial unrest. A comparatively small number of industrial leaders have come to realize that many of these difficulties can be solved most effectively and for the benefit of the industries, the individual workers, and the community through the establishment of systematic and adequate apprentice training.

When thousands of inadequately trained, dissatisfied workmen drift from one industrial center to another, there is a scarcity of skilled labor, high labor turnover, agitation, and unrest. However, when manufacturers throughout the country begin systematically to offer adequate training to boys and young men, giving them an opportunity to become skilled, self-respecting, capable members of the community and industry, the difficulties spoken of will to a large extent, and possibly altogether, disappear.

Harold S. Falk, Vice-president and Works Manager, The Falk Corporation

It is just as important in a country maintaining a high standard of education and general living conditions that boys and young men be taught to earn a living in a skilled trade or occupation, as it is that children be sent to the public schools. To turn boys out of school without providing them with a chance to take their proper place in the industrial field is as dangerous and socially unscientific as it would be to abandon the public school system. If it does not seem so to the casual observer, it is because we are not used to the idea that adequate vocational and trade training is a social necessity; but if we are to make progress in our industrial development and are to establish the kind of social conditions under which such a development can take place, we must, as a nation, come to recognize the fact that no one has been properly trained to take his place in the world until he has been taught how to make a living in some trade or occupation in which he can take a vital interest. In this matter, the interests of the individual, and industry are identical.

The Dignity of Work Should be Made a Fact, Not a Mere Phrase

There is no more constructive work to be done in American industries than the training of men in the necessary and important trades. To accomplish this successfully, however, the trades must be given a new dignity and they must be made more attractive. It should be recognized that the personal requirements for most skilled trades are as high as for ordinary commercial work, and sometimes higher. A machinist is a more skilled man than a bookkeeper, and he gets as much pay, but it remains for industry to assist in making him as highly respected in the community as the bookkeeper.

It is perfectly evident that boys will not be inclined to enter the trades in sufficient numbers until they, as well as their parents, feel that the work in the trade is as desirable from every point of view as clerical work. The combined efforts of the manufacturers in any one locality can change the general opinion in this respect and can make the molders and patternmakers just as important men in civic organizations as bank clerks and insurance men. Proper training for skilled industrial workers will help to achieve this result.

If parents consider mechanical work undesirable for their boys, it is because industry itself has considered such work as of little or no dignity. Work that requires no regular preparation cannot be of great importance, but work that requires a preparation of four years through a regular systematic apprentice system, with supervisors and instructors, is not work that anyone can undertake; hence, the properly trained mechanic, through a systematic apprentice course, rises to a new dignity.

The industry must impress this idea upon the community. It must be made clear that the apprentice system is actually a school, in which the boy is prepared for his life work. He works with his hands at productive work during the four years of his course simply because he is able by that

means to defray the cost of his training. He is working his way through a school, fitting him for positions of responsibility in industry, the same as the boy who works his way through college. To maintain this impression in the community, however, there should be no exploitation of the boy's labor, but he should be given every opportunity to learn his trade thoroughly while he works.

To make a real success of apprentice training, it is also necessary to maintain the interest of the parents in the course, so that they will work with the manufacturer in encouraging the boy to make the best of his opportunities. The parents must be made to feel that there is someone in the shop who is directly interested in the boy and his progress. Submitting monthly reports to the parents, the same as is done in schools, is also advisable. It keeps the parents in close touch with the boy's work and makes them feel that he is being adequately trained and supervised. The parents should also be made to understand that they can come to the shop and consult with the apprentice supervisor if they think this is necessary. The shop should be thought of by the company, the parents, and the boy, as a place where he is receiving a course of training, and not merely as a place where he works.

Any manufacturing plant, and particularly any body of manufacturers in a community organized for the purpose of training young men in industrial work, can create a new attitude on the part of the parents if they will follow the general procedure outlined. Parents will adopt a new attitude when they realize that the manufacturers are honestly endeavoring to stress the educational feature of the apprenticeship system. They will then see the possibilities for the boy's future, and will work with the manufacturers in maintaining the right attitude on the part of the boy.

One difficulty that must be contended with, but that is easily overcome when the educational feature is stressed, is that the earnings of an apprentice, compared with the earnings of a boy who goes into a mass production plant where no skill is required, are at first smaller. A boy going into the mass production plant, however, has no opportunity for advancement and he will earn no more when he is thirty, forty, or fifty years old than he does when he is twenty. The trained man, however, will steadily increase his earnings. Furthermore, if in addition to his trade skill, he possesses qualities of leadership, he will have opportunities ahead of him as foreman and shop executive that are entirely closed to the untrained man.

Creating Interest and Respect for Apprentice Courses

There are many ways in which interest can be created in the community for the apprentice courses provided by different plants. In Milwaukee, talks are given in the high schools by men engaged in the industries. Classes of boys are invited to visit the shops and are provided with adequate guides who thoroughly explain the nature of the work. When properly organized, manufacturers in a community can cooperate with the boys' clubs of the local Y. M. C. A. Giving talks before Boy Scout organizations is another way to interest the boys in learning a skilled trade. In these talks, the relation of great industrial plants to the community and to the general welfare and comfort of the citizens at large should be stressed. It is important that the boys obtain some conception of the true relation between themselves, as part of the community, and the industrial plants.

It is just as important that boys and young men should be taught to earn a living in a skilled trade or occupation as it is that children be made to attend the public schools. To turn boys out of school without providing them with a chance to take their proper place in the industrial field is dangerous and unbusinesslike. If we are to make progress in our industrial development and wish to establish the kind of social conditions under which such development can take place, we must, as a nation, recognize that no one has been properly trained to take his place in life until he has been taught how to make a living in some trade or occupation in which he can become useful, self-respecting, and happy.

What Has Actually been Accomplished by Methods Such as Outlined?

In Milwaukee, where an organized effort on the part of manufacturers has been in effect for several years, the desire to learn the mechanical trades is greater than the opportunities that the shops can offer at present. The Falk Corporation, for example, in 1927, had 157 applicants for the seventeen places in the machinist apprentice training course that were open. In all, the company at the present time has close to 120 apprentices, or approximately one for every eight workers in the shop.

The Milwaukee Plan of Apprentice Training

How manufacturers in the metal-working industries in Milwaukee cooperate in training apprentices has been described in detail in previous numbers of MACHINERY (see September, 1926, MACHINERY, page 20, "The Need for a National Apprentice System," by the writer; and December, 1927, MACHINERY, page 249, "Results of Milwaukee Apprenticeship Plan," by C. J. Freund). It is not necessary, therefore, to go into these details here. However, it should be mentioned that in January of this year, thirty-three shops in Milwaukee regularly trained apprentices and that 905 boys were enrolled in the apprentice systems in these shops.

If the apprentice system in any community is to be really successful, it is necessary that all, or nearly all, the manufacturers cooperate, so that each community is in a position to train its quota of skilled workers. This obviates the need of hiring men from other cities; it makes the community self-contained; it makes the boys and mechanics community-conscious, increases their pride in their city, and is one of the most important factors in maintaining stable industrial and labor conditions.

The Effect of Apprentice Training on Character

No industry can be any better than the sum total of all the men employed in it. The plant with skilled, conscientious workers will progress much more rapidly than one that depends upon a floating supply of comparatively unskilled men. Apprentice training has an effect upon the individual that is

not easily measured. The mere fact that a boy coming out of school remains steadily at work in one place for four years tends to develop his stamina, character, and self-respect.

When a boy can enter an apprentice course immediately after he leaves school—a course that offers something just as definite in regard to duties to be performed and progress to be made as the school—he has an incentive that he does not have if he begins to drift from unskilled employment to employment. It is during the period immediately after school that most undesirable citizens are created. Where the community stops its educational effort, industry must stand ready to take up the work.

The Effect on the Shops

The effect of an organized apprentice system on a manufacturing shop is quite remarkable, and few manufacturers who have not had experience in this direction could imagine what the results have been in plants that have given thorough attention to apprentice training. The boys selected for the apprentice course are usually of a fairly high mentality, and their influence is gradually felt throughout the shop. The boys are interested in the work they are doing, and their attitude creates an increased interest on the part of most of the other men in the shop. In other words, the morale of the shop improves. The activities of the boys outside of the shop also aid in creating a spirit of mutual interest. At the Falk Corporation's plant the apprentices themselves have organized an apprentice association, having its own elected officers. This association has its meetings and social affairs financed by the boys themselves.

The value of apprentice training lies not only in teaching the boy a trade. When the boy remains steadily at work in one place for four years, it also develops his stamina, character, and self-respect. When he can enter an apprentice course immediately after he leaves school—a course that offers something just as definite in regard to duties to be performed and progress to be made as the school—he has an incentive which he does not have if he begins to drift from unskilled employment to employment. It is during the period immediately following school that most of the undesirable citizens are created. Where the community stops its educational effort, industry must stand ready to take up the work.

The Effect on the Community

The effects of organized apprentice systems on the community are far-reaching and will be more and more recognized as this method of training spreads from one or a few communities to a constantly growing number of towns and cities throughout the country. It is recognized that one locality cannot successfully continue to be the only one that systematically trains skilled men, because other communities would then draw their skilled men from the one that has an organized system.

It is a matter of national importance, therefore, that manufacturers in each industrial community throughout the country organize for apprentice training. They have organized in the past for advertising, sales, technical research, and legislation. Why should they not organize to train a sufficient number of apprentices for every American industrial community?

The properly trained boy becomes a better mechanic, a better employe, and a better citizen. He has a clearer understanding of the industry and of the problems of management, and he is better fitted to take up the duties of citizenship intelligently. The standards of the whole community are raised. The earning power of each individual is increased, which, in turn, increases the buying power and creates increased markets for manufactured goods. This, again, means more employment, more opportunities for exceptional men to obtain executive positions—greater chances for the individual. Proper apprentice training is but the beginning of a new era in industrial progress, and ultimately its effects will be felt not in the industries alone, but throughout the entire community.

* * *

CHICAGO SHOP PRACTICE MEETING

The Chicago section of the American Society of Mechanical Engineers held its annual Machine Shop Practice Meeting at the Morrison Hotel on March 14. The meeting included both an afternoon and an evening session, and several papers dealing with shop management and manufacturing methods were presented. Frank W. Curtis, western editor of the *American Machinist* presided. The papers presented were as follows: "Development of Fully Enclosed Gear Drives for Industrial Speed Reduction," by J. A. Marland, engineer, W. A. Jones Foundry & Machine Co., Chicago, Ill.; "Special Machinery for Mass Production," by H. L. Blood, chief of Machine Design Division, Western Electric Co., Chicago, Ill.; "Stopping Production Leaks Through a Simplified Production Control," by K. R. Wood, works manager, Bell & Howell Co., Chicago, Ill.; "The Production of Pressed-steel Frames by Automatic Machinery," by John P. Kelley, sales manager, A. O. Smith Corporation, Milwaukee, Wis.; and "The Relation of Chromium Plating to Industries and the Truth About its Value and Application," by Dr. J. Becker, chief research chemist, Vacuum Can Co., Chicago, Ill.

* * *

EXPORTS OF INDUSTRIAL MACHINERY

The United States' exports of industrial machinery during January, the last month for which complete statistics are available, were valued at $15,120,000, showing a slight decline from the figure for December, which was $15,425,000. The exports in metal-working machinery amounted to $2,538,000 in January, 1928, a considerable increase over January, 1927, when the exports were valued at $1,846,000. It appears that textile machinery exports, which have suffered successive declines during a period of years, are coming back, for the gain which was registered during the entire year of 1927 continued during the month of January, with a total of $1,216,000, as compared with $1,025,000 for January, 1927. Shipments of oil-well machinery and steam engines, on the other hand, declined. On the whole, however, the tendency for the past year, has been for machinery exports to increase.

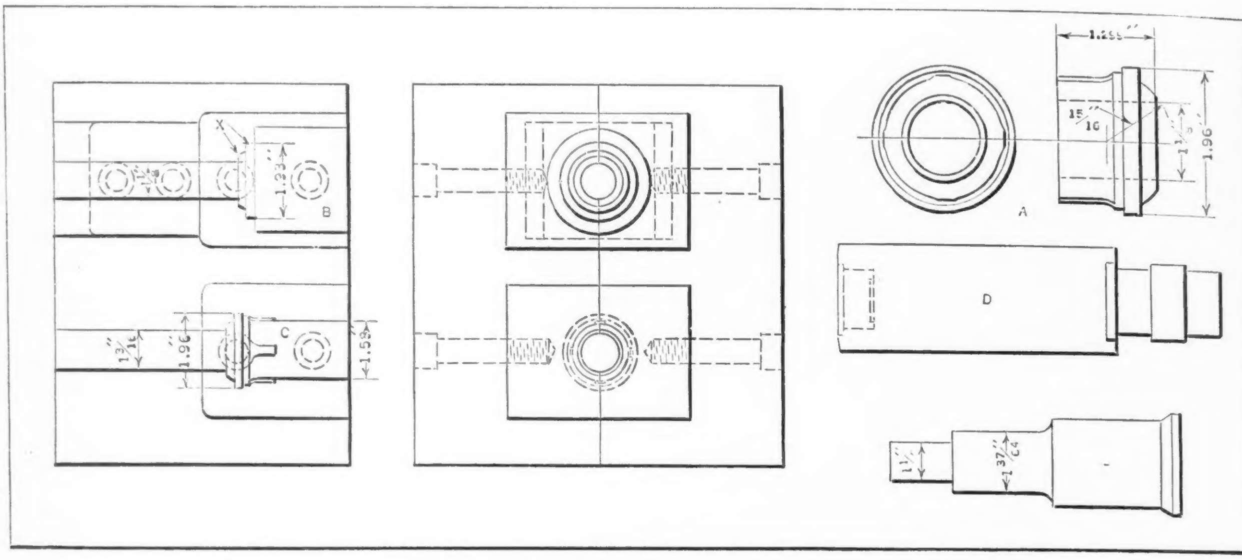


Fig. 1. Dies and Tools Employed in Producing the Male Part of a Pipe Union

Forging Pipe Unions

DIES and tools designed by the Acme Machinery Co., Cleveland, Ohio, for producing the parts of one-inch pipe unions in forging machines built by this company, are shown in the accompanying illustrations. The union consists of male and female parts and a nut for holding these parts together. Each part is produced from bar stock in two strokes of the machine without any loss of material. The production in forging either of the parts averages 550 pieces per hour. Low-carbon Bessemer steel is the material used.

The dies and tools shown in Fig. 1 are employed for forming the male part to the shape illustrated at *A*. For the first stroke of the machine, 1 1/8-inch round stock is extended through impression *B* of the stationary die until it reaches a stop, and then, after the movable die has advanced against the stationary die, plunger *D* advances and heads the stock, as indicated by the dotted lines near the front end of the plunger and the two shouldered sections *X* of the die. Obviously, in this operation the greater portion of the formed stock is enclosed in the front end of the plunger. Not only is the stock expanded to the approximate final dimensions, but the hole is started by the small boss within the opening near the front end of the plunger.

For the second operation, the stock is placed in impression *C* of the stationary die, and as plunger *E* enters the closed dies, the hole is punched through the part, the part is expanded slightly to the final dimensions, the small ribs are formed on the outside, and the piece is cut off the bar. The cutting off is accomplished as the small left-hand end of plunger *E* enters the 1 3/16-inch diameter portion of impression *C*. This portion of the impression is 1/16 inch larger in diameter than the stock, so that the latter can readily slide along the die as the punching off occurs.

Fig. 2 shows the dies and tools used in forming the female part to the shape illustrated at *A*. In the first operation on this part, the stock is placed in impression *B* of the dies and enlarged by plunger *D*, while in the second operation the work is placed in impression *C*, and forged to the final dimensions and cut off by plunger *E*. The general construction

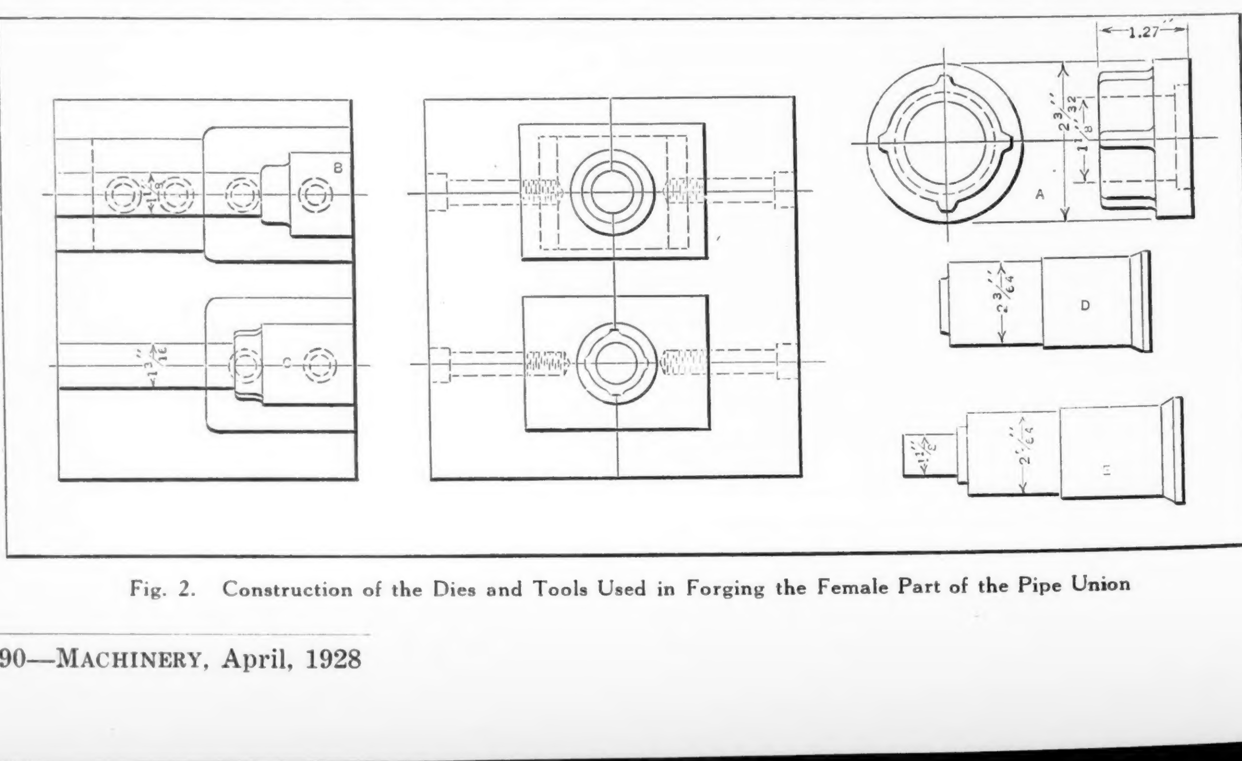


Fig. 2. Construction of the Dies and Tools Used in Forging the Female Part of the Pipe Union

of these dies and tools closely follows those shown in Fig. 1.

The nut for holding the two parts together is shown at *A* in Fig. 3, and is forged by means of the dies and tools shown in this illustration. Round stock 1 inch in diameter, which has a tapered head on the front end produced in forging the previous part, is placed in impression *B* of the stationary die for the first operation. It is expanded to the octagonal shape as plunger *D* enters the closed dies, and the section immediately in back of the octagon is produced to a taper as before.

In the second operation, the work is placed in impression *C* of the stationary die, and is worked by plunger *E* as this tool enters the closed dies. This operation consists of punching a hole through the nut, enlarging the nut slightly, and cutting the nut from the bar. The stock is then left with a tapered head ready for the first operation on the next nut to be produced. It will be seen that the hole extending back through the dies from the large portion of impression *C* is 1 1/16 inches in diameter to permit the stock to slide lengthwise readily as each nut is punched off. The die-blocks shown in all these illustrations are made of chrome-nickel steel, while the tools and die inserts are made of tool steel.

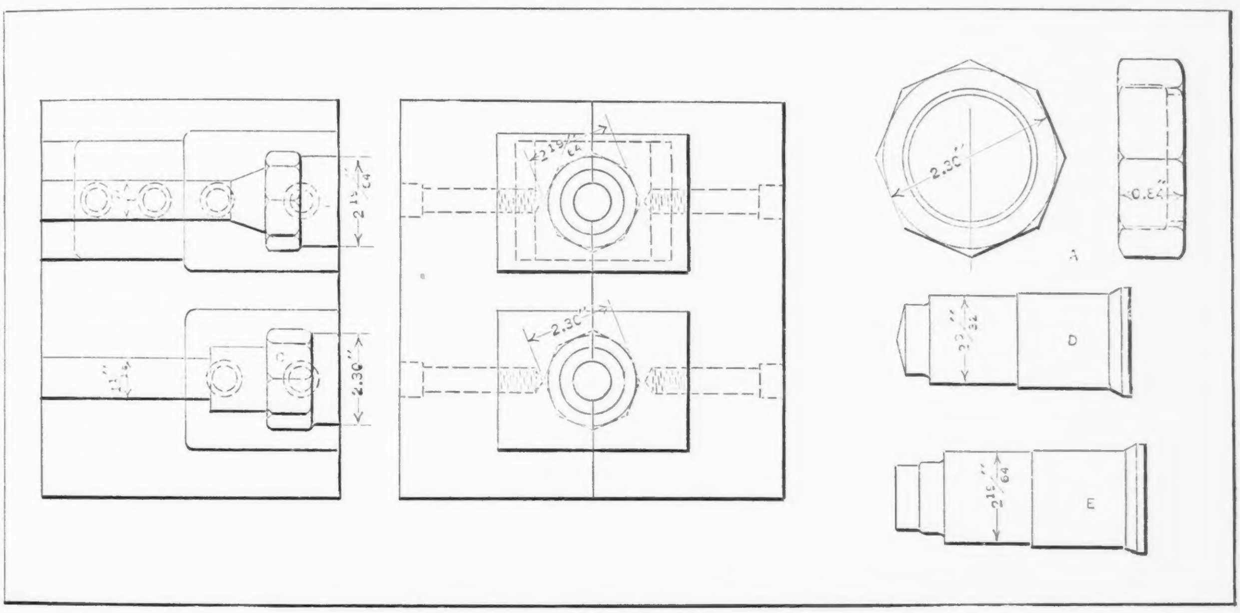


Fig. 3. Design of the Dies and Tools Used in Producing the Pipe Union Nut

* * *

WORLD CONGRESS OF ENGINEERS IN 1929

A World Congress of Engineers is planned to be held in Tokio, Japan, in November, 1929. Secretary Herbert Hoover, as honorary chairman of the American committee of the World Congress, has appointed seventy-eight of the nation's most prominent engineers and scientists as members of this committee, which will promote the aims and purposes of the congress and arrange for the attendance of American engineers. The headquarters of the American committee will be 29 W. 39th St., New York City. The congress, it is planned, will cover a period of two weeks. It is under the sponsorship of the Japanese Government; Maurice Holland, 29 W. 39th St., New York City, is secretary of the American committee.

MATERIALS HANDLING MEETING

The Materials Handling Division of the American Society of Mechanical Engineers will hold a meeting at the Benjamin Franklin Hotel, Philadelphia, Pa., April 23 and 24, to which non-members are invited. There will be four different sessions, one dealing with steel and cast iron foundry transportation, one with the handling of materials at railroad and marine terminals, one with production control and the handling of materials inside manufacturing plants, and one with more efficient handling of coal.

The Materials Handling Division of the A.S.M.E. is one of the sixteen professional divisions of the society. It is the only organization covering the entire field of materials handling. Over 2000 engineers are enrolled in the division. American industry is beginning to awaken to the seriousness of its annual loss due to inefficient material handling methods. It has been estimated that if the methods and equipment at present available for handling materials were used to the fullest extent in the industries, it would be possible to reduce handling costs more than $3,000,000,000.

* * *

SCHOOL FOR ARC WELDING

The school of welding that has been maintained for many years by the Lincoln Electric Co., Cleveland, Ohio, in its plant, has recently been entirely reorganized and re-equipped. The purpose of the school is to train electric arc welders, and no tuition is charged. The course covers thirty days, and includes instruction in the characteristics and manipulation of the electric arc, the nature of welding rods and depositing materials, the operation and care of welding machines, vertical and overhead welding, the testing of welds, cast iron welding, the welding of copper and bronze castings, and the construction of welded machinery frames and fixtures. A. F. Davis, vice-president of the company, is in general charge of the educational work, while the specific instruction is under the direction of a trained instructor.

Notes and Comment on Engineering Topics

The finest wire cloth ever made is said to be a 400-mesh wire cloth recently made by the Newark Wire Cloth Co., Newark, N. J. In 400-mesh cloth there are 400 parallel wires per inch of width running each way at right angles to each other, so that there are 160,000 small square openings per square inch. This fine wire cloth is used for testing purposes, such as testing the fineness of paint pigments, cement, and similar products. The diameter of wire used in the cloth is 0.001 inch. This leaves openings that are 0.0015 inch square.

Oil-electric locomotives for industrial purposes are growing in favor in many large industrial plants. Recently the American Rolling Mill Co., Middletown, Ohio, and the Donner Steel Co., Buffalo, N. Y., installed such locomotives for service at their plants. These engines are the joint product of the Ingersoll-Rand Co., the General Electric Co., and the American Locomotive Co. When locomotives must start, stop, and reverse their direction at frequent intervals, the oil-electric locomotive is very economical, because it uses fuel only when in motion.

At the present time there are over 300 concerns in Germany manufacturing machine tools. During the war and the immediate post-war period, this number was as high as 450, but in the depression that followed, it has been materially reduced. Nevertheless, the number is so great that obviously the result is the keenest kind of competition. There are, for example, 56 builders of drilling machines, 47 makers of engine lathes, 43 builders of grinding machines, and 55 manufacturers of milling machines. Seventeen firms make shapers, and 13, turret lathes.

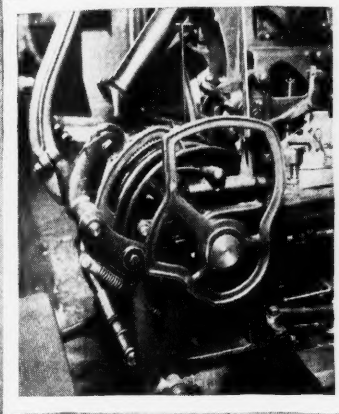
The new electric generating station of the New York Edison Co. at East River and 14th St., which is now under construction, will, when completed, house nine giant generating machines with a total capacity of nearly 1,250,000 kilowatts, or almost 1,750,000 horsepower. The new station will have a capacity nearly twice that of the Boulder Dam or Muscle Shoals development, and much in excess of the combined capacity of the Canadian and American developments at Niagara Falls. The combined capacity of all the power plants in Greater New York at the present time is over 3,000,000 horsepower.

Aluminum alloy pistons are now made for oil engines with bores up to 18 inches, as well as for small gasoline engines. In a paper read before the recent annual meeting of the Society of Automotive Engineers by H. A. Huebotter, chief engineer of the Butler Mfg. Co., Indianapolis, Ind., it was pointed out that pistons made from aluminum alloy are very desirable, because this material has high conductivity and a low rate of absorbing heat from hot gases. Slots cast in the pistons allow for linear expansion of the alloy without a corresponding increase in the diameter of the piston. The paper dealt with the subject in a very thorough manner, containing many illustrations showing the design of pistons and the engines in which they are used.

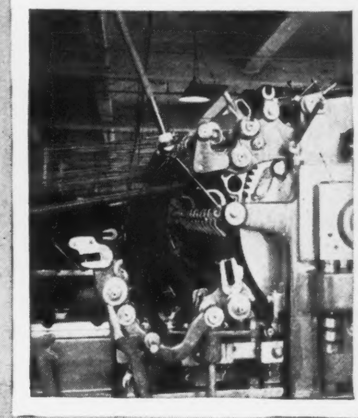
The largest power shovel in the world, both in size and dipper capacity, is being built by the Marion Steam Shovel Co., to be operated entirely by General Electric motors. One scoop load dipped up by this shovel will be sufficient to fill a room 7 by 7 by 8 feet high—about the size of the bathroom in the ordinary home. Enough material can be held in the large dipper of the shovel at one time to fill eight large trucks, and enough coal can be picked up by it to supply the ordinary family for an entire year. The radius of its operation is unusually great. The shovel boom is 120 feet long and the dipper stick 82 feet long. It will thus be able to lift material to a height of from 90 to 100 feet, and will reach out over a radius of 150 feet from the center of operations, covering a circle 300 feet in diameter. All the shovel operations are controlled by one man, although he will probably be assisted by an oiler who will tend the machinery. The total weight of the shovel will be approximately 1350 tons.

In a paper read before the annual meeting of the Society of Automotive Engineers, C. H. Chatfield, who is associate professor of aeronautics at the Massachusetts Institute of Technology, Cambridge, Mass., pointed out that the rivalry between the monoplane and the biplane is of long standing, and that each must, therefore, have some advantages. In structural efficiency, the biplane is considered superior both in strength-weight ratio and in rigidity, but the monoplane has the advantage of being better adapted to metal construction. In aerodynamic characteristics, the monoplane has the advantage on the basis of wings of the same area and profile, but the lower lift-drag ratio and greater unit weight of the monoplane wing tend to reduce its superiority. World's records in performance are divided between the two types, and in speed, the recent Schneider Cup races indicate that the monoplane and the biplane are about equal.

The biplane has the advantage of smaller size, and of affording better vision, but is likely to be more expensive, except that it can be built of wood, whereas the monoplane has to be of metal. The author does not attempt to draw a conclusion as to the general superiority of either type, believing that the decision in any individual case should rest on the circumstances of that case.



Ingenious Mechanical Movements



MECHANICAL ACTION OF PLIERS

By F. J. KEATING

The pliers to be described are designed to combine the merits of the efficient compound lever-cutting nipper and the slip-joint plier. The action is positive, and there are no springs or delicate parts. The compound leverage of the cutters is sufficient to cut easily cold-drawn steel 5/32 inch in diameter.

The two levers *B* and *E* which form handles are engaged with each other by means of a pin *F* having two flats on its periphery. (See Fig. 1.) The hole in lever *B* through which pin *F* passes is so shaped as to make this pin move with it. The hole or slot *N* in lever *E* is of elongated form, and allows pin *F* to pass from one end to the other when lever *B* is turned to approximately 90 degrees with lever *E* so that the flat sides of pin *F* are in line with slot *N*.

On lever *E* at *O* is pivoted a third lever *D* having a cutting jaw *G* formed adjacent to its pivoting point, which engages a similar cutting jaw *H* on lever *E*. Lever *D* has a plying jaw *I* formed on one end (shaped to correspond with its mate *L* on lever *B*), and a pin *C* mounted on the opposite extremity which, when the pliers are in the normal position, is held in engagement with shoulder *J* on lever *B* by pin *A* (also on lever *B*) which engages the contour of the blind cam *K* in the side of lever *D*.

When the pliers are closed in the normal position, pin *F* in lever *B* is in the upper end of the slot *N* in lever *E*, as shown in Fig. 1. In opening, pin *A* on lever *B* causes the cutting jaws to open by reason of its engagement with blind cam *K* in lever *D*. Pin *A* also takes the reaction of lever *D* when anything is gripped between the plying jaws *I* and *L*, and when the pliers are opened in the normal position, pin *A* holds pin *C* on lever *D*, and shoulder *J* on lever *B*, in engagement.

In the operation of cutting, the handles are brought together, and this causes shoulder *J* on lever *B* to engage pin *C* on lever *D*, rocking *D* about its pivot *O*, and thereby causing cutting jaw *G* to move toward its mate *H* on lever *E*. The simple leverage of the cutting jaws is obtained through handle *B*, pin *F*, and shoulder *J*, and is then compounded through pin *C*, pivot *O*, and jaw *G*. When cutting, the reaction of pin *F* is against the end of slot *N*, and wear is negligible where shoulder *J* engages pin *C*, because pins *C* and *F* and pivot *O* are nearly in line, and the travel is therefore very small.

To change the pliers from the normal to the extended position (see Fig. 2), the handles are opened about 90 degrees, and pin *F* is shifted to the opposite end of slot *N;* then the cutting jaws are closed tight by pin *A* which passes to the opposite side of blind cam *K* in lever *D*. In this way, the tool is made "fool-proof," and more capacity is given the plying jaws than if it were possible to cut in the extended position. When the pliers are in an extended position, the shoulder *J* travels through a different arc and allows pin *C* to pass into the opening *P* in lever *B*, due to the location of the lower end of slot *N*.

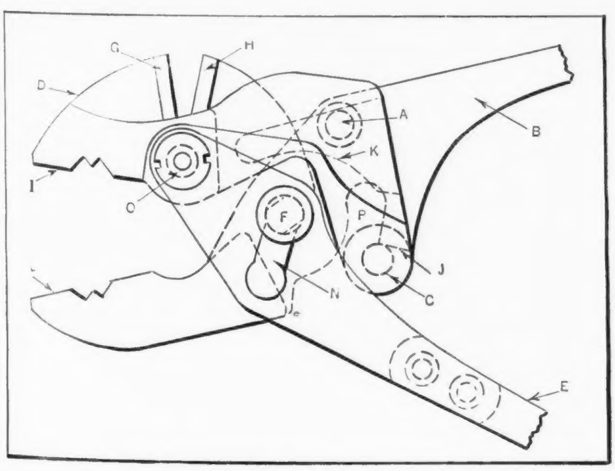


Fig. 1. Pliers in Normal Position

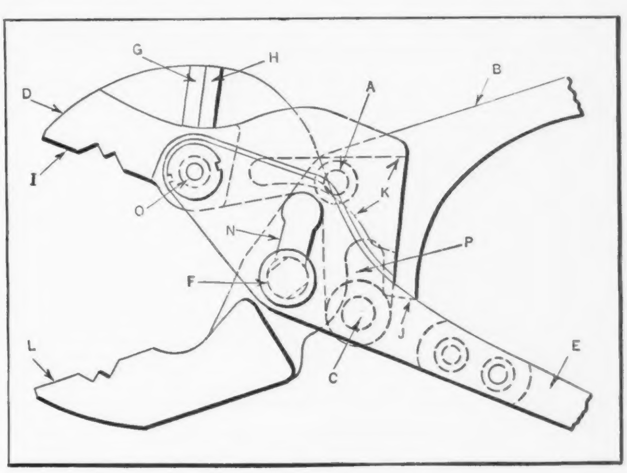
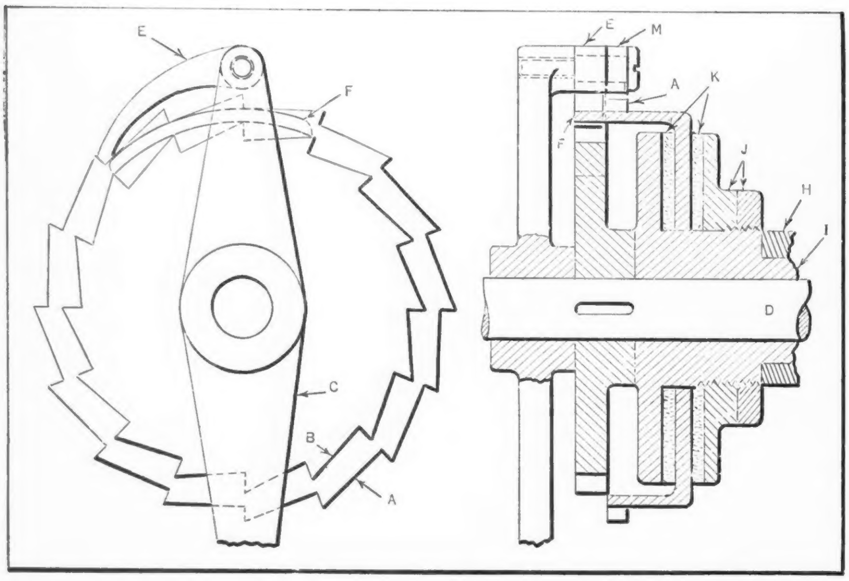


Fig. 2. Pliers in Extended Position



Double Ratchet Having Shield which Prevents One Pawl from Engaging Wheel During Dwell

RATCHET DESIGNED TO "DWELL" AUTOMATICALLY

By J. E. FENNO

When a feed-shaft or other driven member requires a "dwell" after every partial revolution, this may be obtained by a double ratchet mechanism arranged like the one here illustrated. This particular mechanism is designed to give a dwell equivalent to 3 teeth, or 3/16 revolution of the ratchet wheel, after every movement equal to 13 teeth, or 13/16 revolution.

Ratchet wheel *B* has the idle period or dwell, and ratchet wheel *A* carries a shield or guard *F* which prevents the pawl *E* of wheel *B* from operating during the dwell. Ratchet wheel *B* is keyed to shaft *D*, and the auxiliary ratchet wheel *A* is confined between two leather disks *K*, the pressure required being obtained from check-nuts *J*. Pawl *E* engages wheel *B*, as mentioned, and pawl *M* engages wheel *A*. These two pawls are pivoted to and operated by lever *C*, which gives them a movement that is slightly greater than three ratchet wheel teeth.

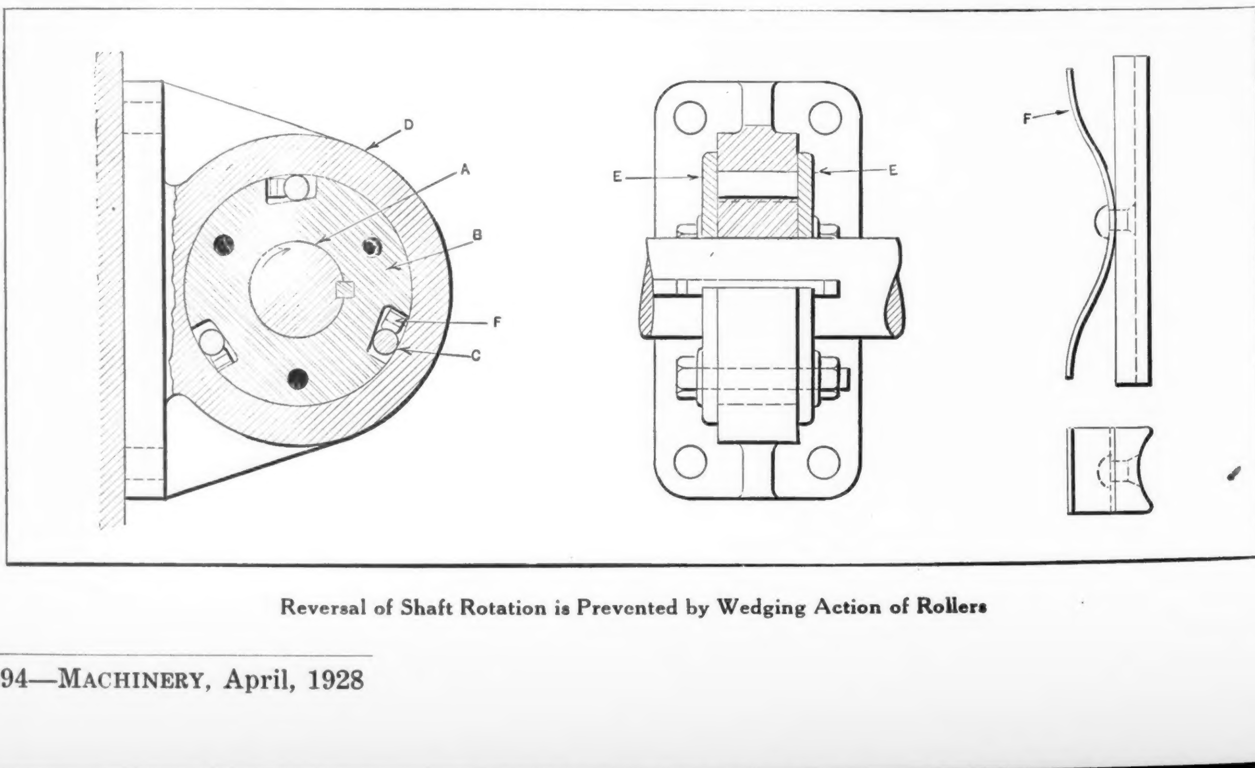
The function of the auxiliary ratchet *A* is merely to carry shield *F* around so as to prevent *E* from engaging wheel *B* during the idle period. The illustration represents the beginning of the dwell, which will continue until pawl *M* has moved *A* around so that shield *F* does not interfere with the action of pawl *E*. Shaft *D* is a running fit in sleeve *I*, which is a force fit in part *H* of the machine.

DEVICE FOR PREVENTING REVERSAL OF ROTATION

By W. G. CAMPION

Some shafts must be free to rotate in one direction but be locked instantly against a reversal of rotation. A ratchet mechanism may be objectionable because of its noise and backlash. Under these conditions, the arrangement shown in the accompanying illustration was found to be satisfactory. Shaft *A* is free to rotate clockwise, but a reversal is not allowed, although when the shaft is not running clockwise, there is always a tendency toward reversal because of torque exerted on the shaft. Keyed to the shaft is a ring *B* into which are cut three wedge-shaped recesses containing rollers *C*. Ring *B* rotates within bracket *D*, which may be bolted to the wall or some immovable structure. Ring *B* and bracket *D* are kept in alignment by retaining plates *E*, which are bolted to the ring. The tool-steel rollers *C* are kept in contact with ring *B* and bracket *D* by means of light springs *F* (see also detail view) which are riveted to their keepers.

When shaft *A* and ring *B* rotate clockwise, the rollers tend to move relatively in the opposite direction, thus compressing springs *F*. This movement releases any wedging action between the roller and members *B* and *D*, although the rollers always remain in contact with these members. Any backward or counter-clockwise rotation is stopped instantly, because the rollers become wedged be-



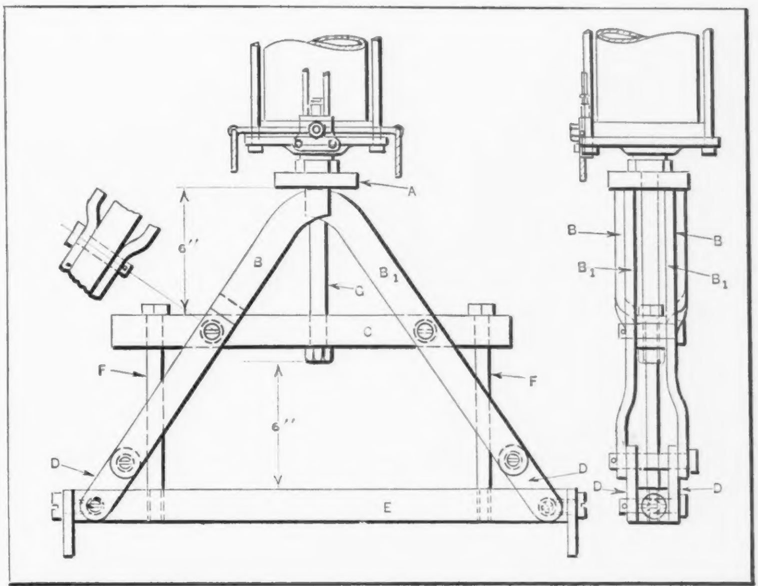
Reversal of Shaft Rotation is Prevented by Wedging Action of Rollers

tween parts B and D, thus locking them together. It is evident that the greater the torque counter-clockwise, the greater will be the locking effect within the limits of the strength of materials used. This simple contrivance proved to be very effective.

INCREASING LIFT OF A HOIST

By CHARLES T. PLASTOW

After installing a 5-foot hoist it was found that 6 inches additional lift would result in an improvement in operation. The "pick up" distance from the floor was fixed and the ceiling height would not permit of a longer hoist, so the extra lift had to be obtained at the top of the stroke. The illustration shows the mechanism used to increase the lift from 5 to 5 1/2 feet.



Mechanism for Increasing Lift of Hoist from 5 to 5 1/2 Feet

Piston-rod G of the hoist supports bar C, from which is suspended bail bar E by bolts F. These bolts F also serve as guide pins when bar E is raised due to the action of links D and levers B and B_1. This extra lifting movement is obtained when the upper curved ends of levers B and B_1 come into contact with plate A, thus causing bail bar E to be elevated 12 inches, while bar C is moving up 6 inches.

STOP MECHANISM FOR PREDETERMINED NUMBER OF REVOLUTIONS

By EDWARD T. HEARD

A mechanism was required in connection with a coil spring winding machine for turning a shaft a predetermined and exact number of revolutions and then stopping it instantly. To obtain the exact number of turns needed, the motion is transmitted through a multiple-disk drive arranged as shown in the illustration. The drive is from pulley A through friction disks B to shaft C, which rotates part D, having a hole at E in which one end of the wire to be coiled is inserted.

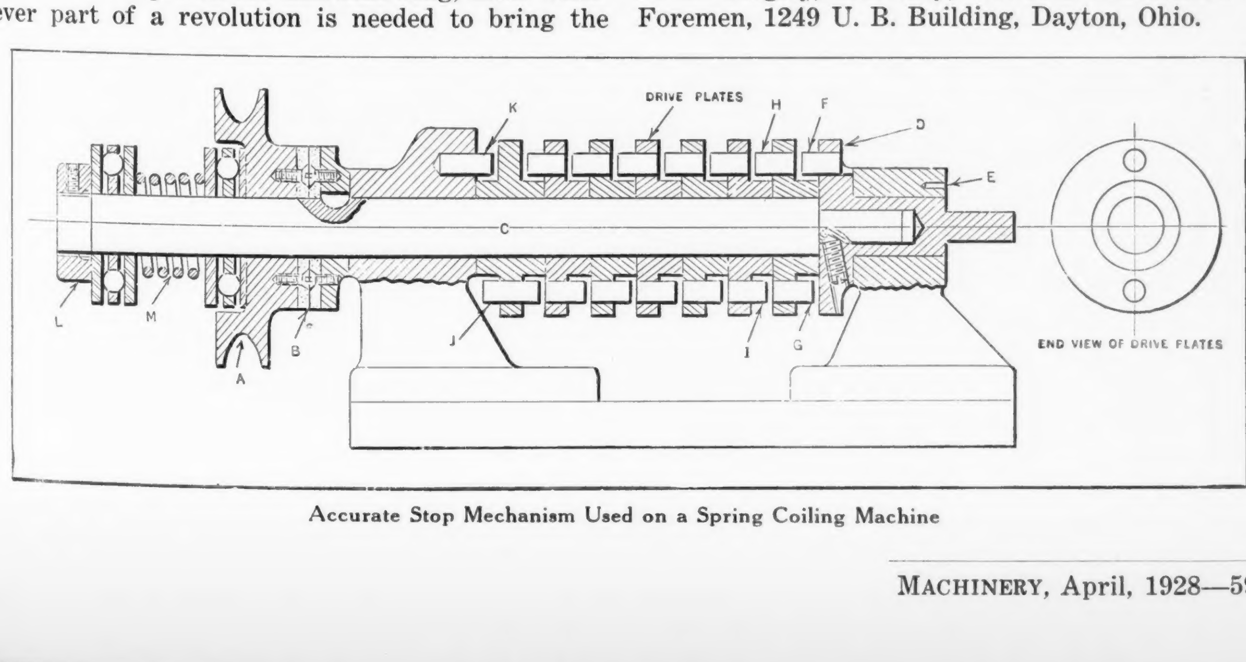
In the flange of part D, there is a pin F which strikes pin G, causing pin H to turn and strike pin I. In this manner, the pin in each successive disk strikes a pin on the disk following, after whatever part of a revolution is needed to bring the successive pins into contact. Finally, pin J in the last disk engages the fixed pin K, which locks the entire combination of disks and stops shaft C immediately as the friction disks B slip, permitting the pulley to continue revolving. The coil spring is then removed, and the drive, which must be equipped with a reverse countershaft, is reversed, the disks being unwound or turned backward until they are again locked in the reverse position.

It will be noted that the frictional resistance between disks B can be varied by means of nut L, which is used to regulate the pressure from spring M located between two thrust bearings.

* * *

CONVENTION OF NATIONAL ASSOCIATION OF FOREMEN

The fifth annual convention of the National Association of Foremen will be held on Friday and Saturday, May 25 and 26, at Canton, Ohio. The general subject of discussion will be "The Foreman as an Executive." Men nationally known in industry will speak on various phases of this subject. This meeting is open to foremen and executives from the industries of the United States and Canada, whether they are members of the association or not. Further information can be obtained from E. H. Tingley, secretary, National Association of Foremen, 1249 U. B. Building, Dayton, Ohio.



Accurate Stop Mechanism Used on a Spring Coiling Machine

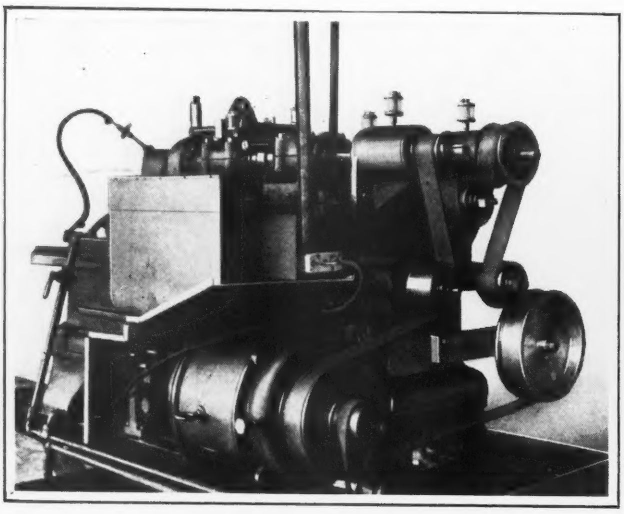


Fig. 1. Driving Arrangement of the Diamond-boring Machine

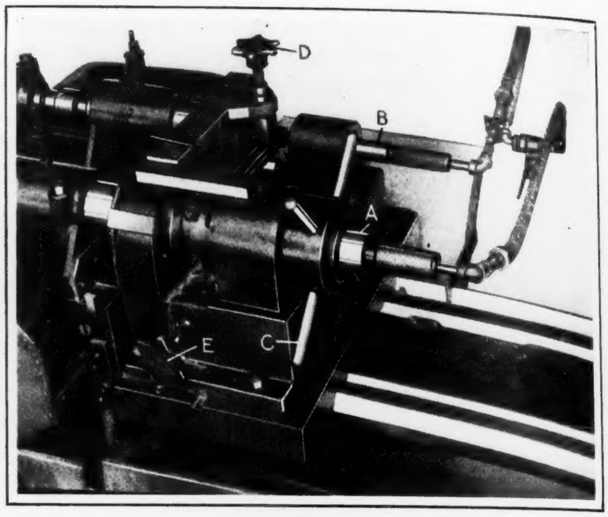


Fig. 2. Fixture in which the Connecting-rod is Held for Diamond-boring

Diamond-Boring Connecting-rods

Features of the Equipment Employed in a Prominent Automobile Engine-building Plant for Boring Both Bearings of Connecting-rods Simultaneously

By C. R. ALDEN, Chief Engineer, The Ex-Cell-O Tool & Mfg. Co., Detroit, Mich.

DIAMOND tools are becoming increasingly popular in automobile plants for boring the bearings of connecting-rods, because of the high degree of accuracy easily obtainable by their use. The Wilson Foundry & Machine Co., Pontiac, Mich., which manufactures engines for Willys-Knight and Falcon Knight automobiles, uses diamond tools for this work. Both the bronze and babbitt bearings of the rods are bored simultaneously in this shop.

An outstanding feature of the method is that the two bearings are not only produced within the close limits specified on the diameters, but with bearing surfaces in excess of 90 per cent, as determined by "wringing" them on a lightly blued plug. Both bearings are also parallel within 0.002 inch, as gaged between plugs at a distance of 10 inches from the connecting-rod center line. The parallelism is checked not only in the plane passing through the two axes, but also in planes at right angles to the first and passing through the separate axes. The center-to-center distance between the bearings is held to limits of plus or minus 0.001 inch. With this method, bell-mouthed and out-of-round holes are eliminated and straightening operations after machining are unnecessary.

An Important Operation Prior to the Diamond-boring

Efforts are made by the company to control all operations on the connecting-rod leading up to the diamond-boring operation in such a manner as to reduce, as far as possible, all stresses that would result in distortion of the finished rod in service. All the usual operations, including broaching of the babbitt bearing to approximate size, are performed before the piston end is bored. To correct any errors in the connecting-rod previous to the diamond-boring and to prepare the hole in the small end to receive the bushing, an operation is added which corrects the center distance between this hole and the babbitt-bearing hole, makes the holes parallel, and brings them into the same plane. For this operation, the rod is located by a plug entering the rough-reamed babbitt bearing, and is gripped on the adjacent cheeks. The piston-pin end of the rod is held by an adjustable clamp. The operation consists of reaming the piston-pin end to size, to receive the bronze bushing, which is pressed into place just previous to the diamond-boring operation.

How the Diamond-boring is Performed

Figs. 1 and 2 show the special machine in which the diamond-boring operation is performed. It is equipped with two high-speed ball-bearing spindles made by the Ex-Cell-O Tool & Mfg. Co. An advantage derived from the construction of these spindles is that piloting, other than that furnished by the spindle bearings, is unnecessary on either side of the bearings to be bored. The rod is inserted in the fixture shown in Fig. 2 and, while holding it by hand, the operator advances the locating plugs *A* and *B* into the babbitt and bronze bearings, respectively. These plugs are hollow and carry tubes through which coolant is delivered to the diamond tools during the operation.

While the rod is still freely located on the plugs, spider wheel *C* is turned to clamp the big end on the cheeks, and another clamp, operated through the star-wheel *D* above it, is lowered to grip the shank of the rod adjacent to the bronze bearing end. This clamp, without causing any strain, prevents side motion of the rod. A third clamp actuated through star-wheel *E*, prevents vertical motion of the bronze bushing end. After all three

clamps have been tightened, the locating plugs A and B are withdrawn to a position just outside of the holes and the boring operation is started. Approximately 0.012 inch of stock is removed from both the bronze and babbitt bearings in the operation.

Upon the completion of the boring, a limit switch simultaneously stops the driving motor and applies a solenoid brake, bringing the tools to an immediate standstill. They are then withdrawn from the finished holes without noticeable scoring. After the three clamps are released, the finished rod is removed from the fixture. On a typical rod handled in one of these machines, the diameter of the babbitt bearing hole is 2.125 inches. This hole is bored at a speed of 965 feet per minute, the spindle making 1735 revolutions per minute and the feed per revolution being 0.0014 inch.

The diameter of the bronze bearing hole is 0.875 inch. This bearing is bored at a speed of 975 feet per minute, the spindle speed being 3470 revolutions per minute and the feed per revolution, 0.0007 inch. It will be noted that the spindle speed in boring the bronze bearing is twice the speed used for boring the babbitt bearing, while the feed per revolution is one-half. As the length of the bearings is approximately the same, this means that both cuts are finished together.

These diamond-boring spindles require no external pilots or boring-bars. The bearings are protected from dust and are copiously lubricated. The spindles are usually operated at a speed of approximately one-tenth that which would be required if the spindles were used for revolving internal grinding wheels. Consequently, more than ten times the life may be expected of a spindle used for diamond-boring operations, as compared with one used for internal grinding. Spindles have been in operation for approximately two years without apparent deterioration of the bearings. The construction of these boring spindles and of their driving spindles is shown in Fig. 3.

General Types of Diamond-boring Machines

There are three common types of diamond-boring machines. In one type, the work-holding fixture is mounted on a movable carriage while the diamond-boring spindles and their driving motors are held in a fixed position and the work is moved to them. In the second type of machine, the work-holding fixture is held stationary, while the boring spindles and their motors are mounted on a carriage which moves to and from the work. In the third type, which is that used in the plant described in this article, the work-holding fixture and the spindle-driving motors are held stationary, while the spindles themselves are located on a movable carriage and are traversed to and from the work. The tool-spindles are driven by means of splined shafts, which permit end movement of the spindles while rotating.

The machines used at the plant of the Wilson Foundry & Machine Co. are built up on a bed similar to that of the ordinary engine lathe. Both tool-spindles are driven from a common motor, the belt from the motor being carried over the pulleys of two driver units, as may be seen in Fig. 1. The purpose of these driver units is to permit sliding of the boring spindles and also to absorb any vibration that may be set up by the belt, so that the vibration will not be transmitted to the boring spindles.

General Data on the Use of Diamond Tools

The hardness of the diamond is proverbial, and while it is true that there is no metal that cannot be cut with a diamond, it is also true that the hardness of diamonds is associated with the same brittleness that is characteristic of most materials possessing unusual hardness. This brittleness causes diamond tools to be likely to have their cutting edges shattered by shocks or impacts, although when held or rotated in a manner that prevents unnecessary shocks, the cutting edges of diamond tools have a life that is almost unbelievable. Diamond tools are seemingly not affected by the heat generated in cutting, and the speed at which diamond tools may be operated is usually limited by conditions other than the cutting speed. In cutting babbitt and softer metals, a better finish is obtained as the cutting speed is increased.

In order to protect the diamond tool against shocks or impacts in ordinary turning operations, the work-spindle bearings of lathes or other machines should be as nearly perfect as possible. When diamond tools are rotated in performing a boring operation, the same necessity for accuracy exists in the case of the tool-spindle. However, operations are frequently performed under conditions that do not permit using plain bearings of large area, such as are ordinarily employed in engine lathe or milling machine construction.

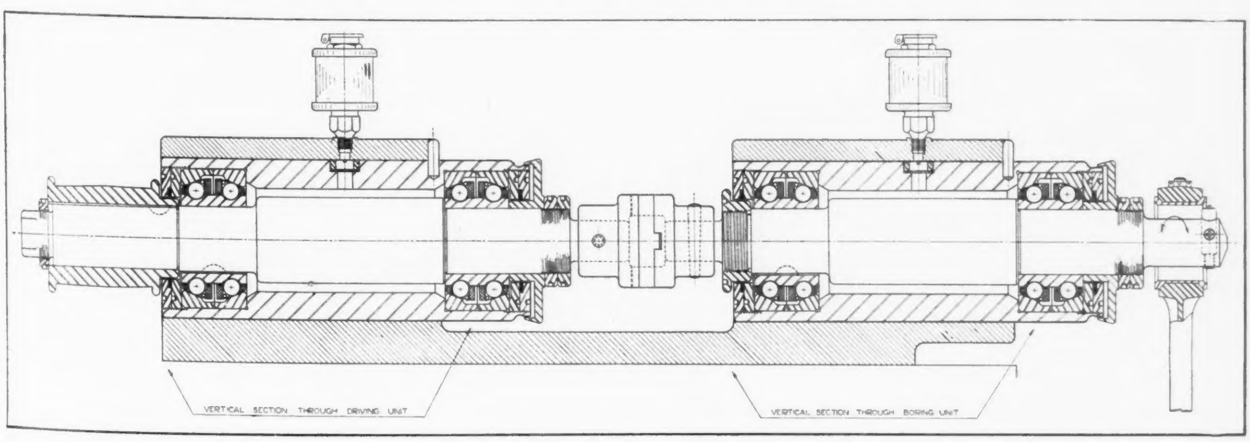


Fig. 3. Construction of a High-speed Diamond-boring Spindle and its Driving Unit

Plain bearings are also subject to certain limitations. If proper clearance is left for the necessary oil film, plain bearings will function satisfactorily at slow and medium speeds. However, the heat generated at higher speeds often lowers the viscosity of the lubricant in such a manner as to increase the effective clearance of the bearings. At the same time the added rapidity with which the spindle vibrates in this increased clearance results in an impact or chatter at the edge of the tool that shortens its life. It is for this reason that the spindles in the machines used by the Wilson Foundry & Machine Co. are equipped with precision ball bearings of a design that was originally developed for high-speed internal grinder service.

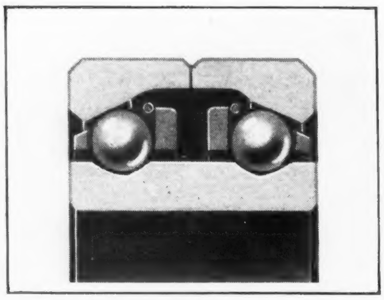


Fig. 4. Precision Ball Bearings Used on the Boring Spindles

Obtaining Precise Ball Bearings

Each spindle ball bearing is of the double-row type illustrated in Fig. 4, having a solid inner race and two outer races. The inner race is so ground that only two contacts are made with each ball. These contacts occur at appropriate angles, and their area is held to a small amount by making the radius of the inner race surface approximately 75 per cent of the ball diameter. The ball contact surfaces of the outer races are conical, being approximately 22 degrees relative to the axis, and it is obviously possible to bring these conical surfaces nearer together by lapping or grinding the inner adjoining faces of the outer races. These faces are in firm mechanical contact when the bearing is assembled in operating relation in a spindle.

Each bearing is a self-contained radial and thrust absorbing unit. Both the inner and outer races are made of the same material and are subject to the same temperature changes. The fitting of the bearing is, therefore, affected a minimum amount by temperature changes, and as only one bearing on a shaft is permitted to carry the end thrust load, temperature changes in a shaft or shaft housing have no effect on the tightness of the bearing.

The design of the bearing, however, is secondary to the precision with which it is fitted for diamond-boring service. Each bearing is first marked on the outer and inner races, so that a given end of the inner race can always be mated with the corresponding end of the outer race. Pairing marks are then added, so that the outer races can always be assembled in the same relation. Then, starting with the bearings so marked and fitted with a degree of tightness that would bruise the balls and races if the outer races were drawn into mechanical contact, the bearing is rotated in a bath of jeweler's rouge and oil which causes the balls to develop an area of contact on the outer races that corrects any imperfections in the races or lack of uniformity in the balls.

This operation is known as the Alden developing process, and a patent has been applied for it. Fig. 5 shows a group of the developing machines. Each machine has a motor which drives a housing loaded with several sets of bearings and the mildly abrasive polishing compound. In this developing process, the outer races are gradually brought together until their adjacent faces are in firm contact. When the degree of tightness, which can easily be determined throughout the operation by electrical means, has reached the desired standard, the developing operation is stopped. The balls and races are left with a very accurate fit and a mirror-like finish.

An amplifying gage for checking the looseness of each bearing individually is shown in Fig. 6. The end play is tested under a reversing load of 20 pounds while the bearing is rotated by a motor drive. The ball point of the amplifying equipment is shown resting on the upper end of the test spindle on which the bearing is mounted. The remainder of the spindle, the motor, and the reversing load spring are located under the table.

Another amplifying gage fixture is used for determining the total end and radial play of a completely assembled diamond-boring spindle or internal grinder spindle. The spindle is so mounted that a reversing end load of 20 pounds can be applied while the spindle is driven at the maximum rate of speed. Spindles can be produced, when desirable, with the total end motion restricted within limits of 0.0001 inch.

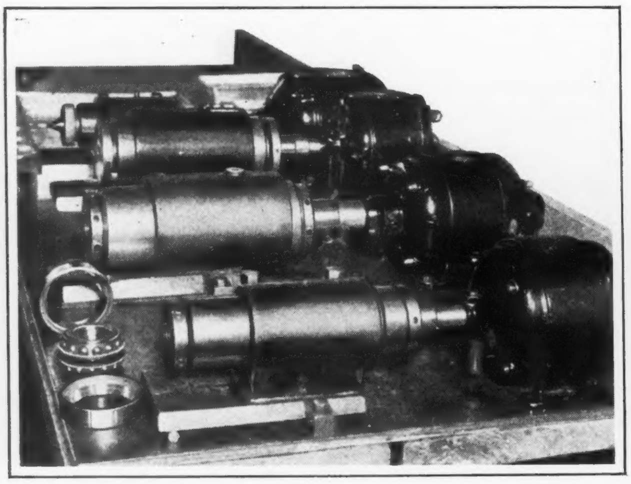


Fig. 5. Four Machines Employed in Lapping Ex-Cell-O Ball Bearings to a High Degree of Accuracy

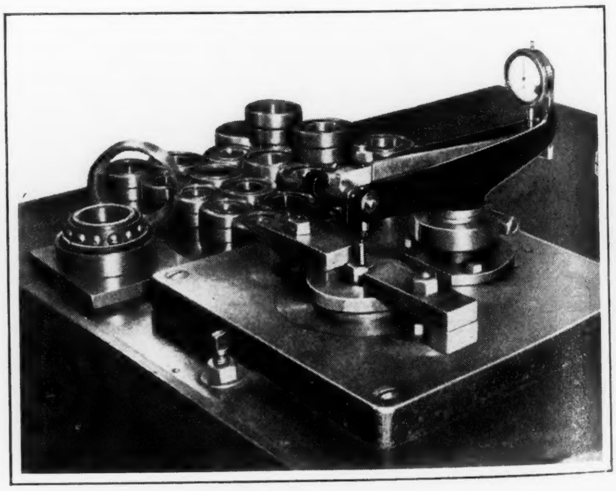


Fig. 6. Fixture Employed for Checking Assembled Bearings for End Play

Simple Boring and Milling Heads

By GEORGE W. WILSON

IN Fig. 1 is shown the conventional type of boring head in which the body *A* is slotted to receive the blades or cutters *B*. The blades are preferably placed at an angle to give rake and keenness to the cutting edges, and are locked in the body by means of taper pins *C*. After the holes for the pins are drilled and reamed, the slots *D* are cut, so that when the pins are driven inward the metal at *E* will be sprung tightly against the blades, locking them securely in place.

Shank *F* is fitted to the body with a taper, and the parts are locked in place by means of the feather key *G*, which runs the full length of the body. Body *A* is provided with a threaded ring *H* against which the ends of the blades rest. This construction prevents the blades from being pushed back or moved when accidentally struck or bumped. A space is left between ring *H* and the body, so that the blades can be moved out to compensate for the stock removed in grinding the cutting ends.

The principal objection to the type of head described is that it requires considerable high-speed steel for the cutters, which become too narrow to be held securely when reground only a few times. The blades are moved out in position for grinding by placing shims at the bottom of the blade slots. The blade slots cut into the tapered bore of the body, even when the slots are made for cutters that

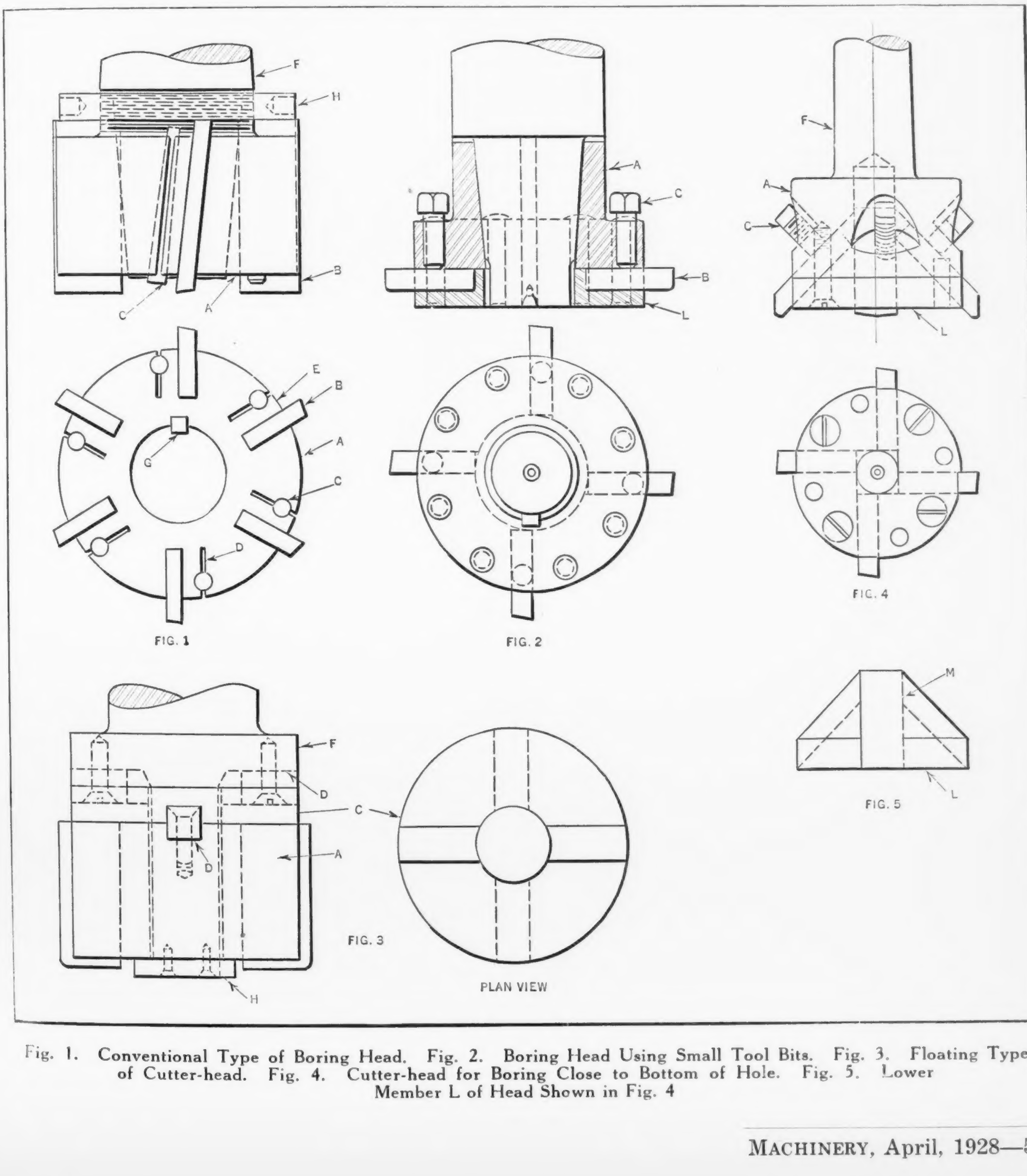


Fig. 1. Conventional Type of Boring Head. Fig. 2. Boring Head Using Small Tool Bits. Fig. 3. Floating Type of Cutter-head. Fig. 4. Cutter-head for Boring Close to Bottom of Hole. Fig. 5. Lower Member L of Head Shown in Fig. 4

have been tapered at the back. The resulting bearing is against the side of the weakened body. This throws an undue side strain on the machine spindle bearing and also tends to loosen the work in the fixture, especially when roughing out cored work in which the hole is off center. The crowding of the work to one side, under these conditions, is particularly noticeable when the cutter becomes dull.

This type of holder, however, makes a fine reamer if given a little "float," as shown in Fig. 3. In this case, shank *F* is made with a center stem that is a loose fit in body *A*. Body *A* is kept in place by means of a washer *H*, which is secured to the stem by machine screws.

The body *A* is driven by means of plate *C*, which is interposed between the flange on shank *F* and body *A*. Plate *C* has two slots milled on opposite sides at right angles to each other, as shown in the plan view, Fig. 3. Keys or drivers *D*, set in slots and screwed to the shank and body, are a sliding fit in the slots in the plate. This construction gives the holder and driving spindle the advantage of an Oldham coupling connection. Body *A* is thus free to center itself in the hole to be reamed, and yet it can be driven without side twist and remain square with the shank. Needless to say, the blades must be square with the top face of the body where it rests against the plate. The plate must be parallel with relation to its sides, and the face of the shank that bears against the plate must be square with the shank.

It is a good plan, when grinding the blades, to take a light cut on the top face of the body and ends of the cutters with a saucer wheel. This will even off any blade that may project a little after being set out. The head is, of course, mounted on an arbor for grinding. Washer *H* should be tight enough to prevent metal dust from working in between the plate and the other bearing parts, and yet permit the body *A* to slide on the plate freely without slack. For a reamer, the blades can be placed parallel with the body. The body is ground to the desired size, after which the blades are backed off as desired.

Instead of using side blades as shown in Figs. 1 and 3, in some cases the writer prefers a head in which square bits are used. This gives a comparatively small area bearing against the side of the hole, and yet provides sufficient adjustment to permit considerable regrinding. The cost of the small bits is also comparatively low. A head of this type is shown in Fig. 2. To simplify construction and facilitate equal spacing of the radial cutter slots, body *A* is made in two parts, *A* and *L*.

Part *A*, which receives the tapered shank, is counterbored to fit the neck or shoulder on part *L*. The cutter slots in part *L* are milled to size, a dividing head being used to obtain equal spacing. The open sides of the slots are covered by riveting part *L* to member *A*. The rivet holes in part *L* are countersunk in order to leave the lower face of the head flush or smooth. Set-screws *C* serve to hold the cutters in place. Packing between the ends of the cutters and the shoulder on part *L* prevents the cutters from slipping back.

When it is necessary or desirable to bore close to the bottom of a blind hole, especially when chips are likely to get beneath the boring head, as when using a vertical-spindle machine for boring a gasoline engine cylinder with the head cast integral, a head constructed like that shown in Fig. 4 can be used. With this design the head can be made of small diameter. The body is also made in two parts in this type of head. Shank *F* is made integral with the body *A*, which is bored to receive the conical part *L*, shown also in Fig. 5. Part *L* is milled to receive the cutters. It is preferable that the cutters be set at an angle of 45 degrees. When parts *A* and *L* are screwed and doweled together, four square holes set at the proper angle are provided for the cutters, which can project beyond the face of the cutter-head.

The cutters are held by means of set-screws *C*. The hole *M* in part *L* provides for holding the part while it is being machined. A plug can be fitted in this hole to back up the cutter. Of course, it is possible to make a solid head and broach square holes for the cutters, but it is very difficult to broach the holes square with the head. Round cutters can be used, but it is difficult to hold them and they do not permit grinding a good shape on the cutting end.

A quick method of making a cutter-head in an emergency is to mill slots across the end of the body to receive the cutters and then calk the cutters in with copper. To do this, the slots should be at least 3/32 inch wider than the cutters. The copper wire for holding the blades is then calked down in the slot on the cutting side of the cutter until the slot is filled. This holds the blade very securely, but does not permit the cutters to be readily shimmed out after grinding.

* * *

WHY COMPETITION IS KEEN

One of the reasons for ruinous competition in the industries, according to J. M. Carney, industrial engineer of Hartford, Conn., is that manufacturers make quotations without taking into account all the factors of cost. In an address made before the Manufacturers' Association of Connecticut, Mr. Carney stated that a manufacturer who desired to purchase a large number of brass parts—about 12,000 a month—such as might be manufactured on a Brown & Sharpe automatic screw machine, received from six manufacturers quotations varying from \$2.20 to \$4.32 per hundred. This is a difference of nearly 100 per cent.

In order to make a thorough investigation, Mr. Carney visited all the plants that quoted, and he states that he is of the opinion that there would not be a difference of more than 5 per cent in the prime costs in any one of the plants. The order was placed and filled at \$2.40 a hundred, apparently at a loss to the manufacturer who made the parts. Mr. Carney states that large users of screw machine products have closed their own screw machine departments, because they can purchase, at much less than their own costs, in the open market.

A brass stamping was sent out as a sample for quotations, and nineteen concerns quoted, the bids varying from \$3.70 to \$9.66 per hundred. Recent bids on gray iron castings are known to have varied from 3.8 to 7.6 cents per pound, and for malleable castings, from 5.9 to 12.8 cents per pound.

Meeting Competition with Improved Milling Methods

By HOWARD ROWLAND

THE examples shown in this article indicate what can be done in solving production problems when a careful study is made of existing methods, and when the machine tool manufacturer cooperates with the producer in solving his problems. In each of the cases to be described a special analysis of the work to be performed was carried on by the machine tool builder in cooperation with the manufacturer. Standard machine tools were used; in some instances, milling machines of the knee and column type were employed, while in others, the fixed-bed or manufacturing type of machine was used. Special time-saving and labor-saving equipment was installed, usually employing automatic features which lessened the work of the operator and made it possible for him to confine his efforts to the loading and unloading of the work, thus allowing the machines to do the rest of the work automatically.

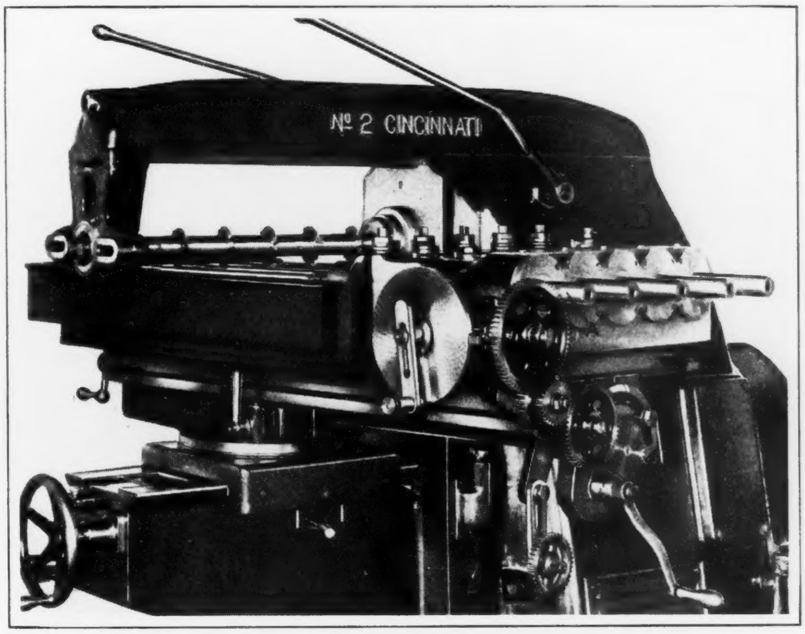


Fig. 1. Knee and Column Type Machine Equipped for Milling Spiral Flutes in Five Pieces Simultaneously, Using a Universal Fixture

In the case of a manufacturer of twist drills and reamers who wished to find a more satisfactory and quicker way of milling spiral grooves, such as are shown in the work at *A*, Fig. 2, a standard universal pyramid column miller of the rectangular over-arm type was selected. On the table of this machine, shown in Fig. 1, was mounted a special five-spindle hand indexing head. Each of the spindles of the attachment, one of which is shown at *A*, carries an independent worm-wheel which is indexed by the indexing mechanism shown. This equipment is part of the regular universal indexing and dividing head, and serves to illustrate how standard parts were employed where possible, in order to keep down the cost and maintain efficient operation.

The standard drive mechanism for spiral milling drives the spiral index-head. Each tailstock is carried in an independent casting, so that it can be readily adjusted to the proper position for pieces of different lengths. In addition, the headstock centers are carried on sleeves that can be adjusted to bring the ends of the work in line with the five cutters mounted on the arbor. This equipment proved very satisfactory, increasing production on various parts from 15 to 35 per cent. The general arrangement of the fixture is shown in Fig. 3. This illustration clearly shows the reason for mounting the headstock spindles on adjustable sleeves, so that the cut will begin and end at the same position on all five pieces.

Another example of the use of multiple heads for holding the work is shown in Fig. 4. The 24-inch automatic miller used in this case is one of a large battery sold to an important manufacturer of automobiles for milling splines in hard steel axle shafts, as illustrated at *B*, Fig. 2. The stock is removed from the solid by three 2 1/2-inch diameter special form cutters, mounted on an arbor 1 1/4 inches in diameter. These cutters revolve at a speed of 104 revolutions per minute, and the feed is 3 7/8 inches per minute. Production was increased from 50 to 75 per cent by the introduction of this method of cutting the splines.

In this case, a special three-spindle automatic indexing fixture or head is mounted on the machine table. This head carries three axle shafts held at the tailstock end on centers, and at the headstock end on push-out collets. Each spindle of the three-spindle heads has individual indexing plates and a plunger for spacing or indexing the work. This method of indexing produced exceptionally accurate work. The work is indexed automatically through the forward and return motion of the machine table.

Each piece of work has six splines or keys, which necessitates feeding the work past the cutters six times in order to completely finish three pieces. The automatic features of the table of this machine, which is part of the standard equipment, were fully utilized. The dogs that control the movement of the table are set at the side, as shown in the illus-

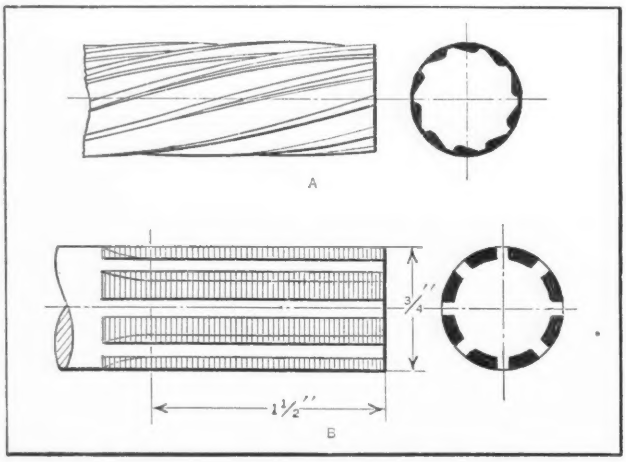


Fig. 2. (A) Spiral-fluted Work Produced with Equipment Shown in Fig. 1; (B) Example of Work Produced on Machine Shown in Fig. 4

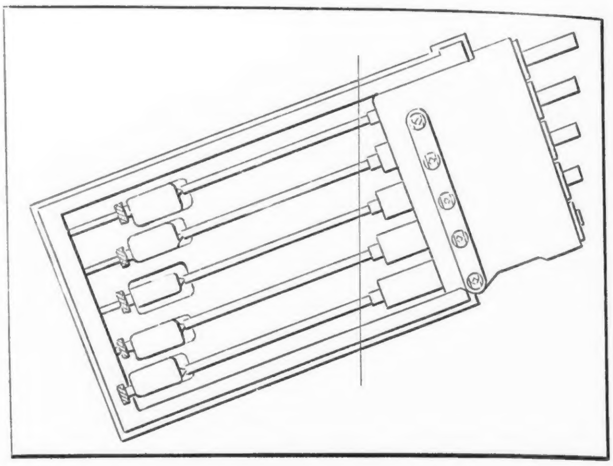


Fig. 3. Universal Fixture Used for Holding Five Pieces of Work while Milling Spiral Flutes on Machine Illustrated in Fig. 1

tration. This not only lessens the labor required to operate the machine, but also serves as a safeguard against milling work of this kind too far.

Milling Clutch Teeth

There are many different ways in which clutch teeth can be milled. Perhaps one of the best methods yet devised is that shown in Fig. 9; here the operation consists of milling the teeth in clutch members like the one shown in Fig. 7. The teeth in this case are milled from a solid steel blank, using a single 5-inch diameter alternate-tooth slotting cutter. A table feed of 9 1/4 inches per minute is employed, which permits cutting one side of each piece in 2.95 minutes. The time required to complete one piece as indicated in Fig. 7 is 5.9 minutes.

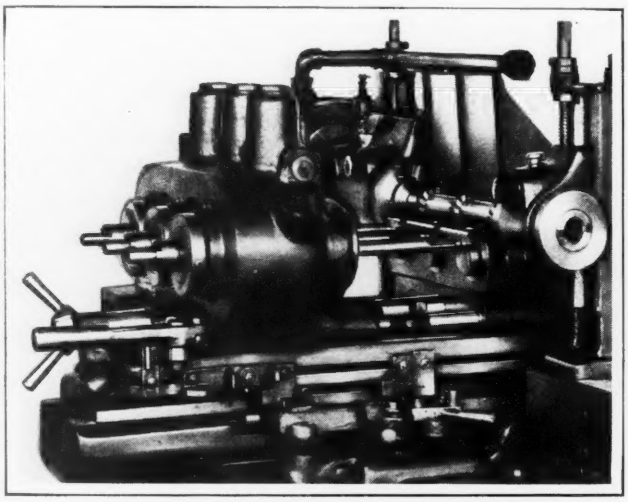


Fig. 4. Plain Automatic Milling Machine Equipped for Spline Milling; Fixture Indexes Automatically

In this case, the equipment consists of a special automatic indexing fixture arranged to permit cutting odd numbers of teeth, from three to nine, inclusive. The indexing fixture is operated automatically, and the machine cycle of the table is also automatically controlled. The required number of divisions can be readily obtained by setting the dial *A*. The handle *B* throws out the flipper dog, so that the table can be returned to the loading position, where the work will entirely clear the cutters. This operation temporarily disengages the mechanism that automatically controls the cycle of operations.

The spindle of the fixture has a large bore and is of sufficient length to hold clutches mounted on shafts that are 12 inches in length. It is also designed to hold fork clutches which must be located by a stud and the cross-hole. The particular clutch shown in Fig. 9 is of the two-way type, and is held and located by a stud. Various types of top plates are used for holding different kinds of work. When the machine is in use, the operator simply removes the finished piece and replaces it with a new piece of work, starts the machine, and

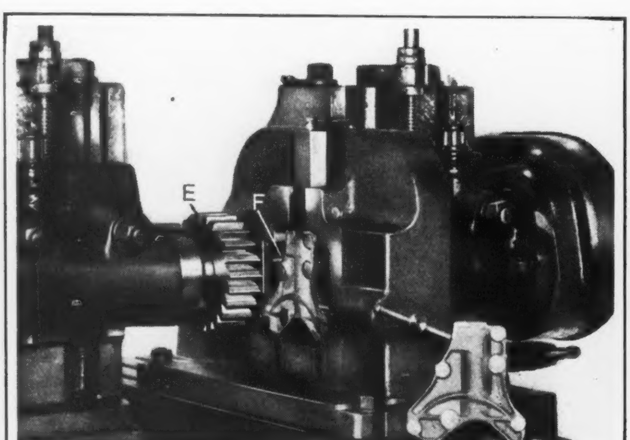


Fig. 5. Automatic Duplex Machine Equipped for Milling Bosses on Work Shown in Fig. 8

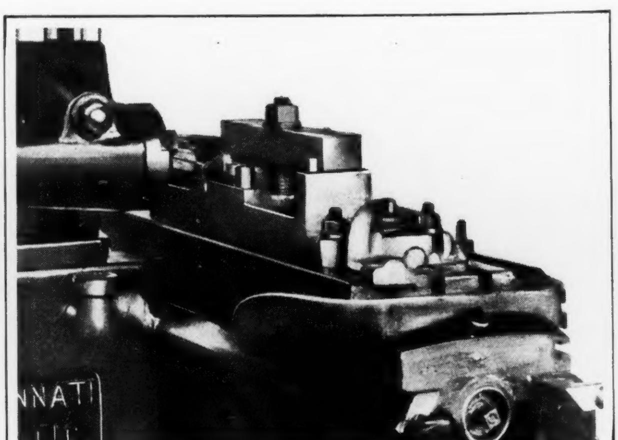


Fig. 6. Plain Automatic Milling Machine Set up for Milling Pads on Casting Shown in Fig. 8

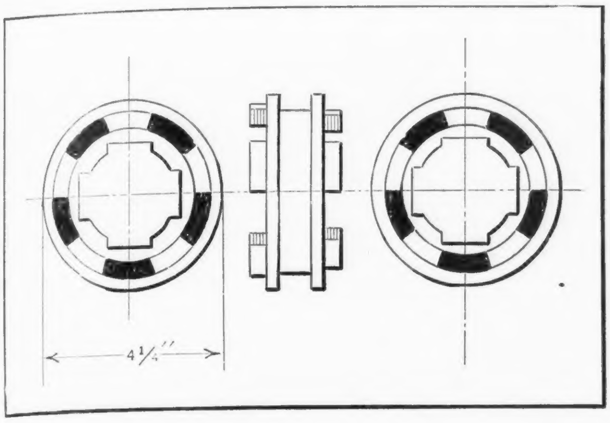


Fig. 7. Clutch Milled with Equipment Shown in Fig. 9

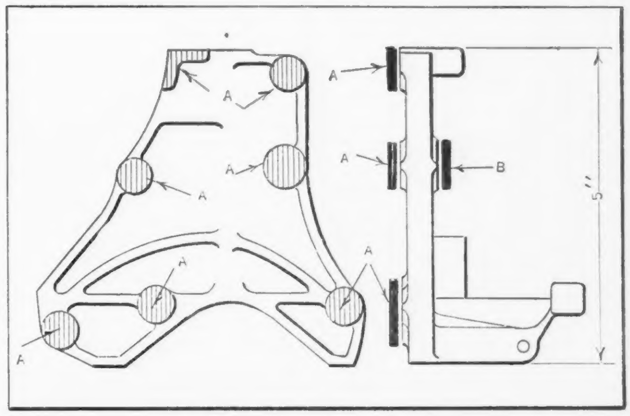


Fig. 8. Work Milled on Machine Shown in Fig. 5

after finishing the new piece, lifts up the flipper dog, which allows the table to run out to the loading position. All the operations performed on the machine are, therefore, automatic. The intermittent table feed can be set to jump the space between the clutch teeth, thus saving considerable time and increasing production, as it practically cuts in half the distance traveled at the cutting feed.

Milling Bosses

In Fig. 5 is shown a 24-inch duplex automatic milling machine equipped for milling simultaneously the bosses A and B on the iron casting shown in Fig. 8. About 1/16 inch of stock is removed by the 6-inch diameter stellite shell mill E and the 2-inch end-mill F, Fig. 5. The feed employed is 16.6 inches per minute, giving a production time of 0.77 minute per piece, or a production of approximately 68 pieces per hour, making allowances for ordinary shop delays.

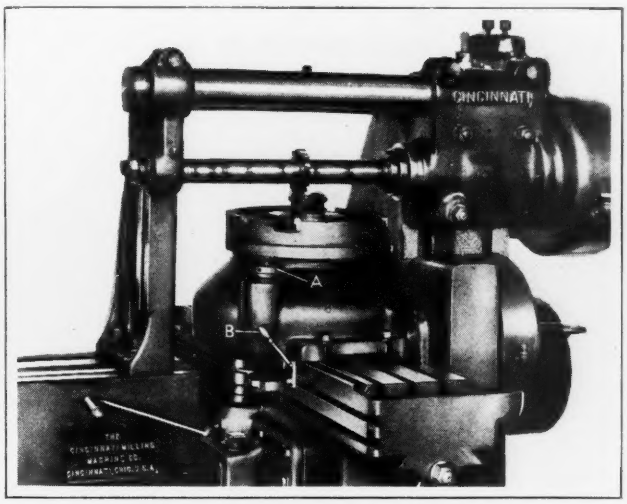


Fig. 9. Plain Automatic Clutch Tooth Milling Equipment, with Automatic Indexing Fixture

As shown in the illustration, one piece is held in the fixture mounted on the machine table. The work rests on two fixed supports and against a fixed stop. It is clamped over the top, and is stopped by the hand-screw shown at one side of the fixture. The operator's duties consist merely of unloading and loading the fixture and throwing in the starting lever of the machine. As the work travels past the cutter, the large end-mill machines the seven bosses A, Fig. 8, on one side of the casting, and the small end-mill finishes the boss B on the other side. The table is automatically returned at a rapid rate to the starting position, where it stops automatically.

In Fig. 6 is shown an automatic plain milling machine equipped for milling the end pads of the casting shown in Fig. 8. The high-speed steel shell end-mill in this case removes 1/16 inch of stock, with a feed of 18.3 inches per minute. The time per piece on this operation is 0.42 minute, and the hourly production approximately 124 pieces. In this case, a simple fixture which has a strap clamp mounted directly on the machine table holds one piece. The work is located from a previously finished pad and against two side stops and one end-stop.

Milling Clearance Notches in Axle Housing

In Fig. 10 is shown a fixture for holding a pressed-steel rear axle housing of the banjo type

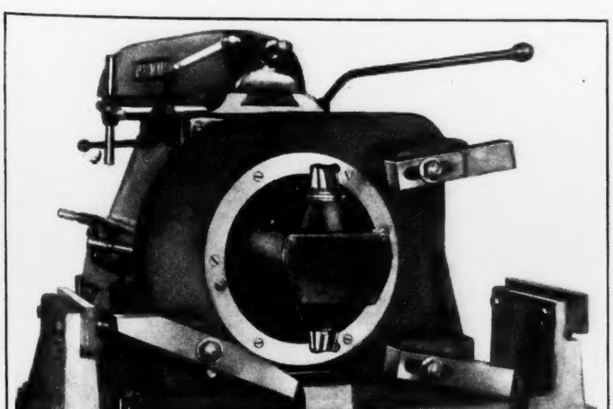


Fig. 10. Milling Fixture Used in Cutting Clearance Notches in Rear Axle Housing Shown in Fig. 12

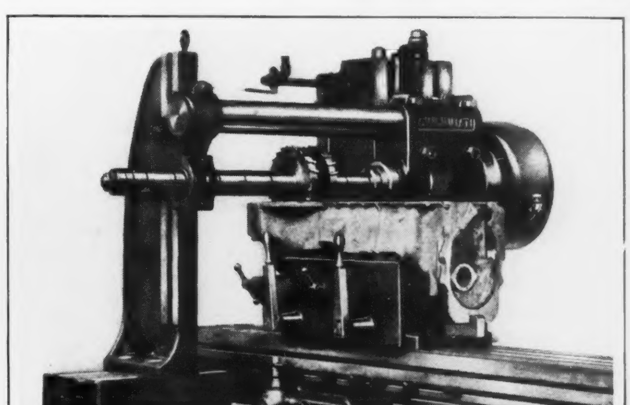


Fig. 11. Machine Equipped for Milling Cap Seats on Aluminum Crankcase

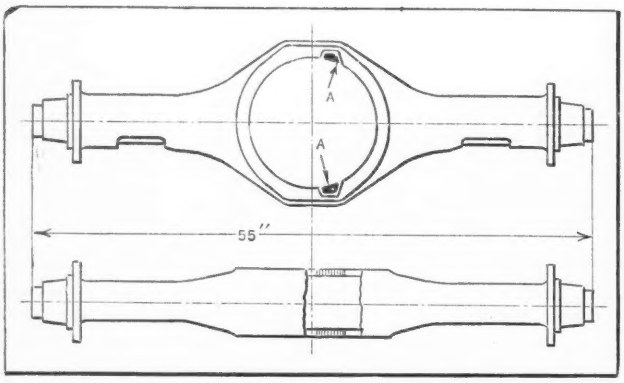


Fig. 12. Rear Axle Housing with Clearance Notches Milled at A

while milling the clearance notches *A*, Fig. 12, for a ring gear. Stock is removed from the solid by two 2 3/8-inch diameter special formed spiral end-mills mounted on the spindle of the special attachment. The production, using a feed of 7/8 inch per minute and with the cutters revolving at a speed of 154 revolutions per minute, is 22.6 pieces per hour. The special vertical-spindle internal milling attachment having a cutter on both ends of the spindle, as shown in Fig. 10, is mounted on a plain high-power pyramid column milling machine.

The fixture holds the banjo type housing securely in place with its major axis in line with the table. The work is slid into position and located approximately in the machining position by two hardened guide strips at each end of the fixture. Two dowel-pins which fit two holes in the differential housing face, insure accurate alignment when the work is clamped against the fixture by the three clamps. The cross-feed is, of course, employed in milling the notches.

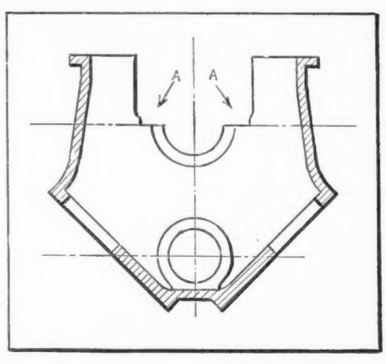


Fig. 13. Cross-section View of Crankcase on which Cap Seats are Milled at A

The machine shown in Fig. 11 is equipped with a fixture for holding an aluminum crankcase while finish-milling the cap seats *A*, Fig. 13. In this case, the machine is equipped with a special high headstock and tailstock. The tailstock carrier is of the cap type, so that the arbor can be easily removed from the machine. The machine is also equipped with a special length table which has a travel of 72 inches. Special bed extension table support brackets are provided at the front and rear.

The work is loaded at the front of the machine and removed at the rear, where the table is automatically stopped at the end of the cut. This method was employed so that the accurately milled surfaces would not return past the cutters. Two quick-acting clamps secure the work in place.

This is a good example of a case in which a simple fixture on a specially equipped machine resulted in a large reduction in the production time. In fact, the time required to machine this particular piece was cut down from 30 to 40 per cent. The two 14-inch diameter inserted-blade half side mills, mounted on a 2-inch arbor, remove 1/8 inch of stock. The cutter speed is 210 revolutions per minute, and the feed 15.2 inches per minute. The actual production time is 2.22 minutes per piece.

WELDING AIR RIFLE BARRELS ON LATHE

By DONALD A. HAMPSON

Over half a million air rifles are made annually in the plant of the Daisy Mfg. Co. at Plymouth, Mich. The barrels of these rifles are blanked out of sheet steel in sizes to suit the different models, and they go through a series of forming operations that culminate in the blued or nickeled barrel known to the boys of four generations.

Some ingenious tools and interesting operations are employed in the forming of both the metal and wooden parts of the guns. There is one operation upon the barrels that will doubtless be of interest to mechanical men, as it involves the combination of the lathe and welding equipment. The operation is that of welding the butt seam along the barrel with a torch.

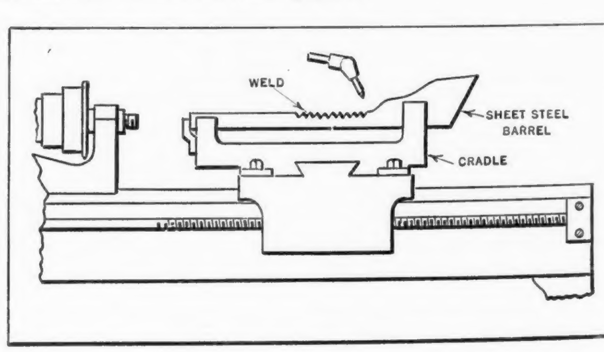
The accompanying illustration shows how the lathe and torch set-up is used. The seam is on the under side of the barrel, and is welded for a length of approximately 6 inches along the middle portion, the length varying according to the model of the rifle. The lathes, together with the welding torches and clamping fixtures, constitute semi-automatic welding machines of moderate cost.

The lathe was selected as the basic unit for the improvised welding machines because of the carriage movement it provided. The simple fixture mounted on the carriage is provided with suitable clamps. The stop at the left-hand end of the barrel can be adjusted to suit the size of the work. The welding torch is fixed in such a position that its flame, at welding heat, centers over the seam in the barrel.

When the barrel and the torch are in the proper position, the carriage feed is engaged, causing the barrel to travel past the welding flame until the movement is stopped either by hand or automatically, at the completion of the work. A colored glass shield is attached to the carriage for the protection of the operator's eyes. With this equipment, five to ten barrels are welded per minute.

* * *

More than 95 per cent of the passenger cars, buses, and trucks in the world are either manufactured in the United States or assembled in foreign branches of American plants.



Lathe and Welding Torch Set-up for Welding Air Rifle Barrels

EXPERIENCE VERSUS THEORY IN DESIGNING

By E. H. FISH

Some time ago, in endeavoring to get certain ideas across to a class in mechanics, I wrote several short articles pointing out things that might happen to a machine tool from other than legitimate use, as for example, the damage that might result from someone bumping a truckload of castings against a low hanging gear-box. Some of my good friends commended me for letting it be known that the value of a design lies in the ability of the designer to take all factors into consideration, while others took me to task for my views.

Hoover Defines Two Types of Minds

Why there should be this difference in viewpoint remained a mystery to me until I ran across an old copy of the *Saturday Evening Post* in which Herbert Hoover was quoted as follows: "There are two types of mind—the doctrinaire mind and the practical mind. The doctrinaire is set on fixed principles . . . He will spend endless time on his plans before he will start to do anything. Then when he does start, the very first thing he encounters is a situation that the plan does not cover . . . His action is forever being paralyzed by his theory."

Thousands of engineering school and college graduates commencing actual drafting-room work become disappointed when they find so little opportunity to use things they have been taught. They find themselves confronted by the need for action, if only to erase what they may have already drawn. After a little while, they discover that paper is inexpensive, that the way to design machinery is to start to draw, and that the first design, as well as the second, will probably be thrown away. They find that the hardest things to do are to start and to stop drawing. The old saying "Once begun is half done" should be in their minds, so that they will realize that the beginning is one-half the job. To be sure, an end view may be found creeping on a front view or there may be large open spaces of clean paper between views, but what of it? The point is to begin to draw—to do something. Afterthoughts will come.

Not every machine can be so worked out that the first one built will be a success, but in the machine tool business there is more than an even chance that the new machine will prove O. K. from the start, provided the work on the drawing board has been well thought out. And there is the nub of it all, "well thought out." The man who makes a good designer can see from his drawing how the machine will go together and how it will work. He uses his handbooks as a means to an end, and that end is to save him time.

How Men with these Different Types of Mind Look upon a Designing Problem

A type of man who seldom makes a good designer is the student type; he believes all that he reads and relies entirely on his books rather than on himself. The man who does succeed is the type who does his own thinking. One man looks at a shaft as a beam carrying definite loads; another looks at it as a possible seat of trouble if a monkey-wrench gets into the gears. One man sees a grinding wheel as something rather fragile, which has been tested at so many revolutions per minute; the other sees a workman getting the corner of a casting between the wheel and the rest. One man sees a shear blade strong enough to cut off a red-hot bloom; the other remembers that blooms cool off, and makes the blade strong enough to shear them at a blue heat.

Experience is Often Gained by Making Mistakes

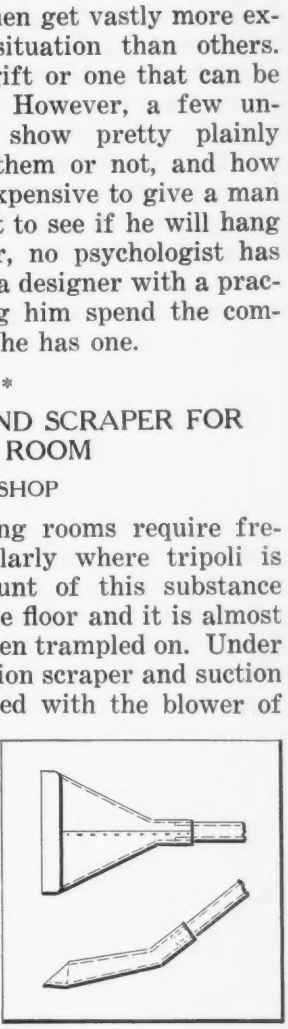
Theory a designer must have—he must be sure that everything is strong enough for legitimate use, and then must add here and there for possible contingencies. This ability is based on what we term "experience." Some men get vastly more experience out of a given situation than others. Whether this is a natural gift or one that can be acquired, I do not know. However, a few unpleasant experiences will show pretty plainly whether a man learns by them or not, and how much he learns. It seems expensive to give a man a piece of valuable rope just to see if he will hang himself with it, but, so far, no psychologist has told us how we can pick out a designer with a practical mind except by letting him spend the company's money to prove that he has one.

* * *

VACUUM CLEANER AND SCRAPER FOR POLISHING ROOM

By W. F. BISHOP

Most buffing and polishing rooms require frequent cleaning up, particularly where tripoli is used. A considerable amount of this substance generally finds its way to the floor and it is almost impossible to sweep it up when trampled on. Under these conditions, a combination scraper and suction or vacuum cleaner, connected with the blower of the exhaust system as described in the following, can be used to advantage.



Scraper and Inlet for Polishing Room Cleaner

A gate valve is built into the main suction pipe close to the blower. A lever is provided for closing this valve, so that the maximum suction of the blower can be obtained for the inlet of a small conductor pipe. This small pipe is run down the wall to a convenient point for attaching a suitable length of vacuum cleaner hose.

To the end of the cleaner hose is attached a scraper and cleaner inlet, such as shown in the accompanying illustration. All dirt loosened by the scraper is drawn up and discharged through the blower. When the cleaner is not in use, the vacuum cleaner hose is disconnected and the conductor pipe closed with a cap.

* * *

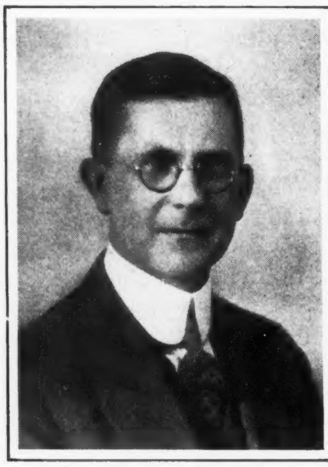
An interesting new departure in transportation has been made on some British railways where huge tank cars, holding 3000 gallons, lined with glass, and provided with an asbestos covering, are employed for transporting milk.

Bending Moments of Beams

A Discussion of the Maximum Bending Moment of Beams Ordinarily Considered as Having Fixed Ends

By JOHN FLODIN, Assistant Professor of Machine Design, University of Minnesota, Minneapolis, Minn.

NO doubt every designer has wondered to what extent it is possible to realize the ideal condition of fixation for a beam with fixed or "built-in" ends. Our formulas are based on the hypothesis that neither bending nor deflection of any kind can occur outside of the planes considered as the ends of the beam. Since this probably is an unattainable condition, many designers prefer to consider all beams as freely supported, except those that are parts of cast machine frames and that are stiffened by large fillets. But to consider a structural beam such as may be used in a machine foundation as having freely supported ends, when the ends actually are fixed, means using a member of twice the section modulus really necessary, assuming the load to be concentrated at the middle of the beam. It is therefore desirable to find a convenient means for determining, at least with a fair degree of accuracy, the actual maximum bending moment in a beam with ends that are not absolutely fixed and yet are too well fastened to be considered as freely supported.



JOHN FLODIN, who since 1923 has been a member of the mechanical engineering faculty of the University of Minnesota, has had a somewhat varied career. In 1900, he left high school to go to sea. After eight years of circling the world on the decks of sailing ships and in the engine rooms of steamers, he obtained a stationary engineer's license in Seattle, and spent the next year in power plant operation. In 1909, he entered the University of California as a special student, and in 1913 he graduated from the mechanical engineering department of the University of Washington (Seattle). Except for one year, during which he took graduate work at the University of Washington, Mr. Flodin spent the next ten years in marine design work. In 1919, he was awarded the M. E. degree by the University of Washington, and in 1925, the M. A. degree in literature by the University of Minnesota.

For a simple beam with supported ends and the load concentrated at the middle, the maximum bending moment $M = WL \div 4$, where W is the superimposed load, and L the length of the beam. (The weight of the beam will be ignored throughout this article, although it will later become clear that the reasoning here advanced applies equally well to combined loads.) Toward the ends of the beam the bending moment is reduced directly as the distance from the end is reduced, the graphical representation being given at A in Fig. 1. For a similar beam with built-in ends, the bending moment at the center is $WL \div 8$, which is also the arithmetical value of the bending moment at the ends, as indicated by the bending moment curve B, Fig. 1.

For the beams shown, the lengths and loads are alike, and so the two bending moment graphs are also alike, the only difference being in the locations of the beams with reference to the graphs. At C the two graphs are combined to serve for both beams: For a free-ended beam when the base line is taken as the horizontal line at the bottom of the figure, and for a fixed-ended beam when the base is taken as the horizontal line at height $WL \div 8$.

If now the vertical distance between these two horizontal lines be divided into a percentage of fixation scale, as indicated, we may draw our base line at whatever position most nearly corresponds with the end condition of the beam under consideration. Thus, if we propose using fairly heavy riveted brackets that approach, but cannot be considered as fully meeting, the requirements of complete end fixation, the base line may be drawn horizontally between, say, the 75 per cent marks. For this position of the base line, the bending moment at the center of the beam becomes $5WL \div 32$.

In case the fastenings at the two ends of the beam

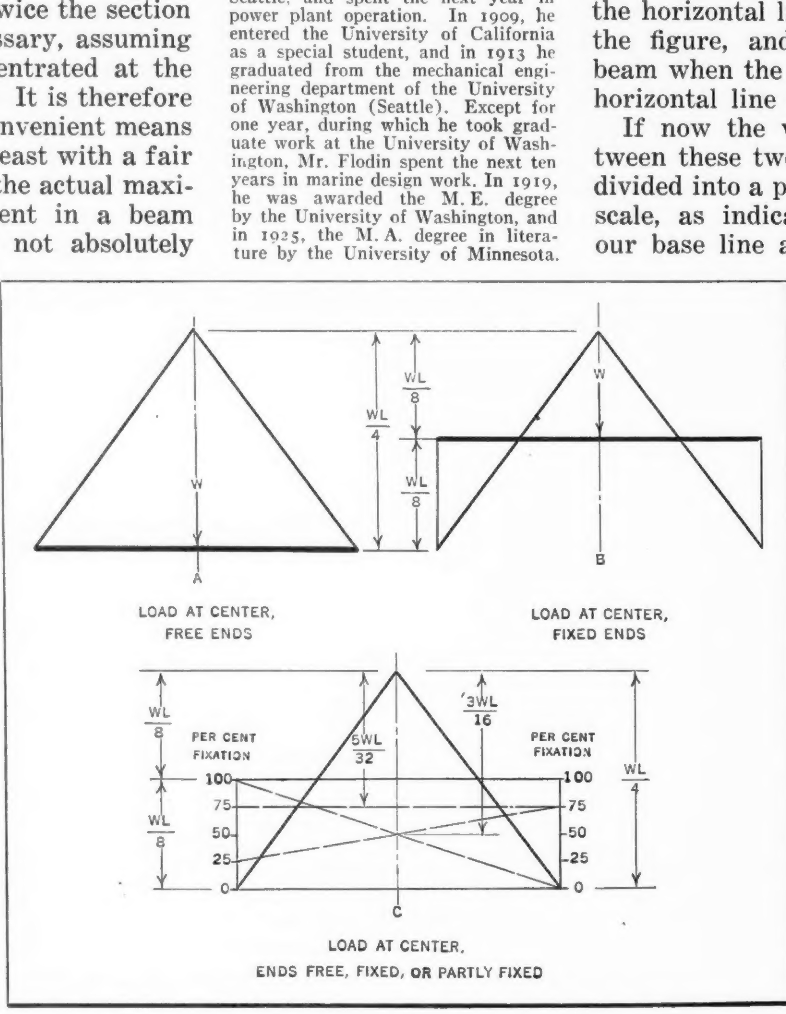


Fig. 1. Bending Moment Graphs for Beams Loaded at the Center

Comparison of Approximate Graphical and Mathematical Results for Stresses in "Free-Fixed" Beams

	Load Concentrated at Center		Uniformly Distributed Load	
	Mathematical Results	Graphical Results	Mathematical Results	Graphical Results
Maximum negative bending moment.......	$\frac{5}{32}WL$	$\frac{6}{32}WL$	$\frac{9}{128}WL$	$\frac{14}{128}WL$
Bending moment at point of fixation....	$\frac{3}{16}WL$	$\frac{2}{16}WL$	$\frac{1}{8}WL$	$\frac{1}{8}WL$
Distance from fixed end to point of maximum bending moment.......	$\frac{L}{2}$	$\frac{L}{2}$	$\frac{5}{8}L$	$\frac{4.63}{8}L$
Distance from fixed end to point of zero bending moment..........	$\frac{3}{11}L$	$\frac{2.21}{11}L$	$\frac{L}{4}$	$\frac{L}{6}$

Machinery

are not the same, so that one end may be regarded as having, perhaps, only 25 per cent fixation, while the other end has a fixation of 75 per cent as before, the base line becomes oblique, as indicated, and the bending moment at the center becomes $3WL \div 16$. It should be remarked that the length of the oblique base line does not represent the length of the beam, and that the bending moments are given by the vertical ordinates between the base line and the bending moment curve.

For a beam having a uniformly distributed load and free ends, the maximum bending moment is equal to $WL \div 8$ and is at the center of the beam. With fixed ends, the bending moment at the center becomes $WL \div 24$, and at the ends, $WL \div 12$. The bending moment curves, as shown at *A* and *B*, Fig. 2, are parabolas that must be alike for beams of the same length, since the arithmetical sum of the positive and negative bending moments for the fixed-ended beam $= WL \div 24 + WL \div 12 = WL \div 8$, which is the height of the bending-moment curve for the free-ended beam. These two curves may, therefore, be combined (as was done with the curves of beams with concentrated loads), as shown at *C*. Percentage divisions are given at the ends of the diagram, as before, and the new base lines indicate the applicability of the method used for beams with concentrated loads.

While the base line remains horizontal, or nearly so, the method here described gives quite accurate results, but with a sloping base line, that is, with different degrees of fixation at the two ends, there is an appreciable though not a serious error. It is therefore well to see how reliable this approximation is by checking the results it gives, as compared with the most accurate results obtainable. For such a check, it is desirable to take the worst possible case, which means that we should assume a beam that would give the greatest possible base-line slope. We shall, then, choose a beam fixed at one end and freely supported at the other, although such a beam would ordinarily be handled by the more exact mathematical method rather than by means of this approximation. Since mathematically accurate formulas are available for free-fixed beams, we may readily construct a table that will give the comparison at a glance.

It will be seen that for both loadings, the maximum bending moment given by the graphical method is in excess of the corresponding mathematical result, the only graphical result not on the side of safety being the bending moment at the point of fixation for the beam with the concentrated load. This is a discrepancy which it may be well to bear in mind in cases where a variable cross-section is to be used, but is ordinarily of no importance, since the bending moment at the point of fixation is not the maximum bending moment.

There are as yet no reliable data available that would definitely indicate what degree of fixation may safely be expected from different types of end fastenings, so that this question must, at least for the present, be left to the judgment of the designer.

* * *

This is no country for prophets of gloom. How many so-called saturation points have already been passed at full speed? We are a progressive people. The possibilities of growth and development have yet to be plumbed. Improvements in processes and products have reached a high degree of perfection, but we have only begun to explore the field of economic distribution and selling. This, as a necessary phase of developing our production, is industry's immediate problem.—*Charles M. Schwab*

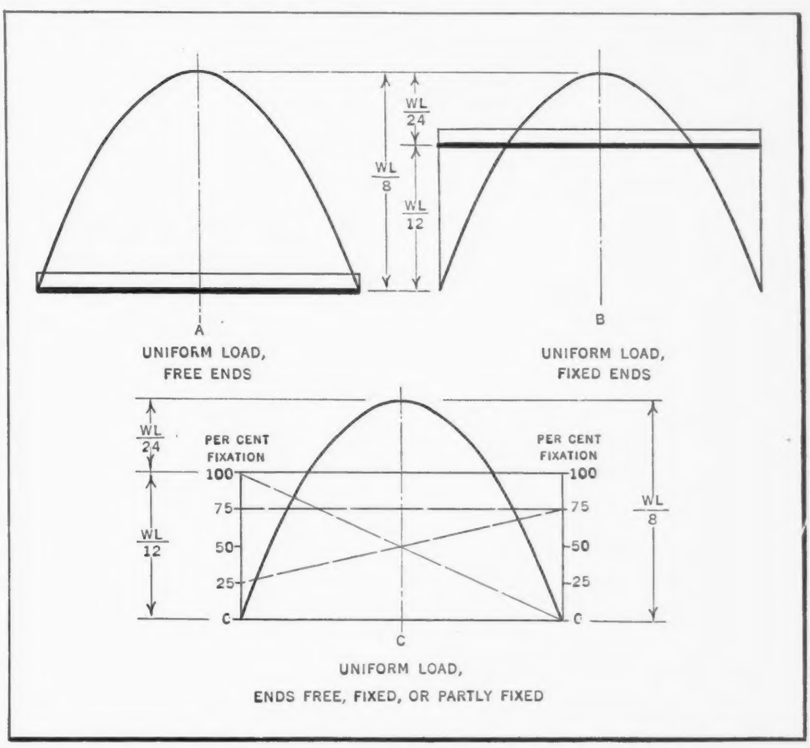


Fig. 2. Bending Moment Graphs for Beams Uniformly Loaded

MACHINING VEES IN COMMUTATORS

Commutators for electrical equipment are made up of any number of tapered copper plates up to several hundred, with a sheet of mica between each plate. On the inside these assembled copper and mica sheets are generally machined to a vee, and later a correspondingly machined ring is slipped over this vee to hold the pieces together.

Fig. 1 shows how the vee of commutators is machined in the Renewal Parts Plant of the Westinghouse Electric & Mfg. Co., which is located at Homewood Station, Pittsburg, Pa. The required number of copper and mica sheets are stacked in a holder made up of three forgings which are held together by means of bolts. Then the bolts are tightened to clamp all the sheets firmly together, and the holder is mounted on the faceplate of a turret lathe, as shown.

The first step in the operation consists of rough-facing the commutator with a tool mounted on the square turret, and then taking a rough-boring cut on the vee with a second tool on the square turret. The hexagon turret is next advanced toward the work a certain amount, after which two tools on this turret are used successively for taking finishing cuts on the vee. These tools are fed by means of a hand-crank and are guided at the proper angle. The long side of the vee is usually tapered to an angle of 3 degrees, and the short side to an angle of 30 degrees. Finally, a third tool on the square turret is used to round the edge of the short side of the vee.

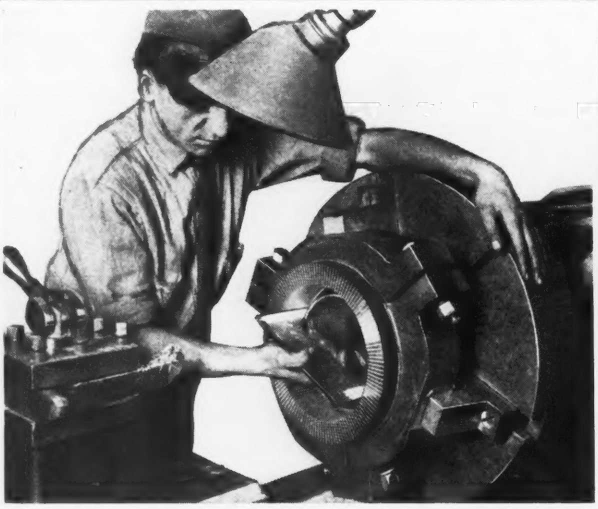


Fig. 1. Checking a Vee Bored in a Commutator

In Fig. 2 a girl is shown using a small flexible-shaft driven burring cutter for under-cutting the mica sheets slightly in relation to the copper plates on the inside of the commutator.

* * *

Gas-electric drive, which hitherto has been confined in automotive applications to the driving of buses and snow plows, is now found to have many advantages when applied to trucks. This has recently been demonstrated by an analysis of the operation of nineteen gas-electric trucks owned by the Philadelphia Rural Transit Co. During a period of three months, 27,500 miles were covered without road failures and engine trouble.

COPPER-PLATING BEFORE CARBURIZING

By ERNEST L. HOLCOMB

One of the methods used for copper-plating sections of machine parts so as to localize the carburization during heat-treatment is to paint the areas to be hardened with black asphaltum varnish, which is baked before copper-plating. The carburizing heat is depended upon to burn off the varnish after the copper-plating, thereby leaving the surface free for the carburizing action. Another method is to cover the areas with sheet rubber or tire tape while copper-plating the remainder.

Neither of these methods is convenient if the parts to be treated have holes that are to be carburized. The holes would have to be plugged before copper-plating and the plugs removed afterward. If the parts have many slots, teeth, or other uneven surfaces that require local hardening, it would also be rather expensive to paint or otherwise cover such surfaces to prevent them from being plated with the copper.

Fig. 2. Under-cutting the Mica Sheets of a Commutator

There are three other methods that the writer believes to be preferable:

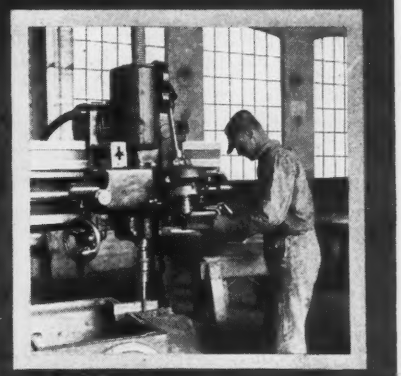
1. Copper-plating the entire part before the finishing cuts (such as milling, reaming, etc.) are performed on the areas that are to be carburized. This saves all extra work.

2. Adding a special lapping or polishing operation after copper-plating to remove the copper from the surfaces to be carburized. This method is sometimes of value when no grinding is required after hardening, because the lapping between copper-plating and carburizing provides a better finished surface.

3. Packing the parts in special pots for carburizing in such a way that new bone surrounds the sections that require carburizing, while sand, cinders, spent bone or fireclay—in fact, any suitable material sufficiently free from carbon—surrounds and protects the other areas.

Some carbonaceous materials affect the copper plate, and care must be used to obtain a sufficient thickness of copper. Experience will demonstrate what thickness is necessary for different conditions. This thickness should then be maintained by some accurate method of checking.

Letters on Practical Subjects



TOOL-HOLDER FOR SHAPING DIES AND KEYWAYS

Special tool-holders for shaping dies and keyways are provided in many shops. Among the many tool-holders of this kind used by the writer, the design shown in the accompanying illustration has proved the most satisfactory. This type of holder does not mar or dent the tool. The tool can, therefore, be turned or its position can be changed without removing it from the holder, in order to bring the cutting edge close to a square corner. This cannot always be done when a set-screw is employed in the usual way to hold the tool, owing to the interference caused by the burr which the set-screw throws up.

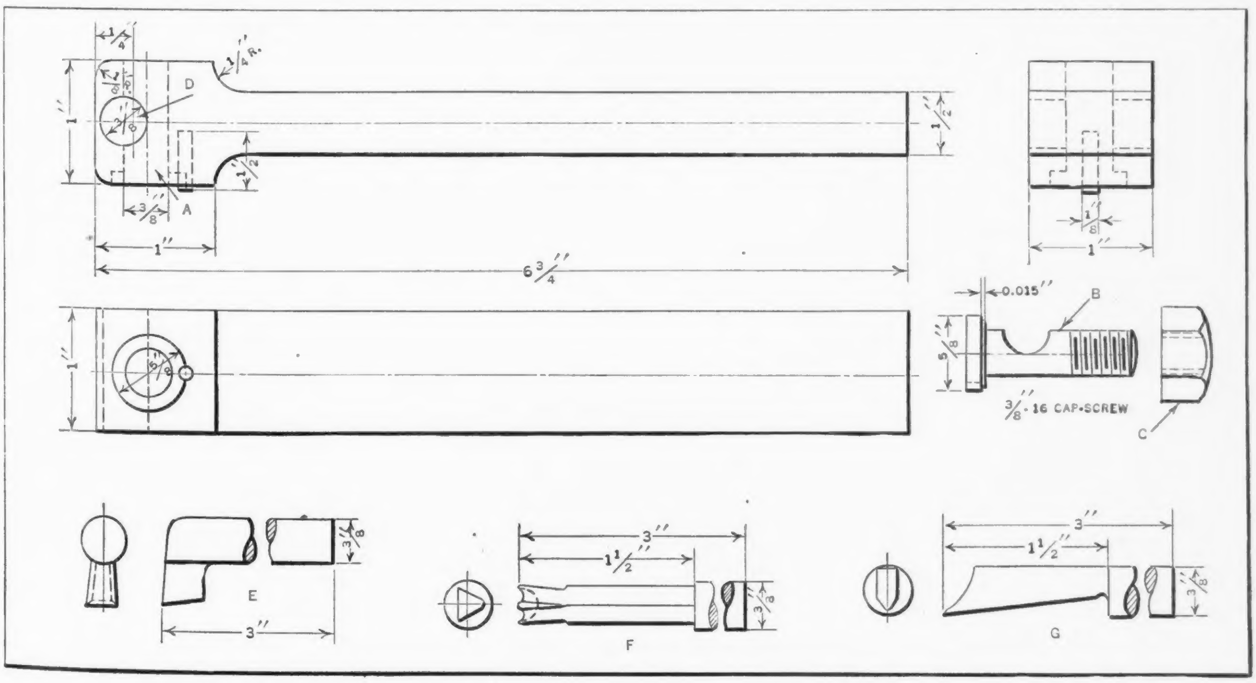
The tool-holder shown in the illustration is made of cold-rolled steel and is casehardened. In constructing the holder, a 3/8-inch hole is first drilled, reamed and counterbored through the side, as shown at *A* in the illustration. A cap-screw *B* having a square or hexagon head turned down to a diameter of 5/8 inch, with an additional 0.015 thrust section under the head as indicated, is inserted in the hole *A* of the holder and drawn up tight by means of a nut *C*.

A 1/8-inch hole is next drilled through the side of the head and cap-screw *B*, and into the holder. A pin is driven into this hole, as shown, to prevent the cap-screw from turning. The hole *D* for the tool is then laid out, drilled, and reamed. The cap-screw is next removed and the 0.015-inch shoulder under the head turned off. Then the cap-screw is again inserted, the tool put in its place, and the cap-screw drawn up tight, making the tool ready for use.

Three typical cutting tools that can be used to advantage in the holder are shown at *E*, *F*, and *G*. The tool shown at *E* is used chiefly for cutting keyways, while the tool shown at *F* is a combination type having three cutting edges. When one edge of tool *F* becomes dull, the tool is simply turned in the holder to bring one of the other cutting edges into the cutting position. Thus the tool requires sharpening less frequently and therefore saves time.

The tool shown at *G* is used for die work. It can be used for finishing square holes, as its cutting edge is ground to such an angle that it prevents the metal from breaking out over the line. The tools shown are made from 3/8-inch drill rod, forged to shape, hardened, and ground. The tool-holder may be used on any ordinary shaper. It is suitable for any kind of shaping work, but is best adapted for die work.

C. A. M.

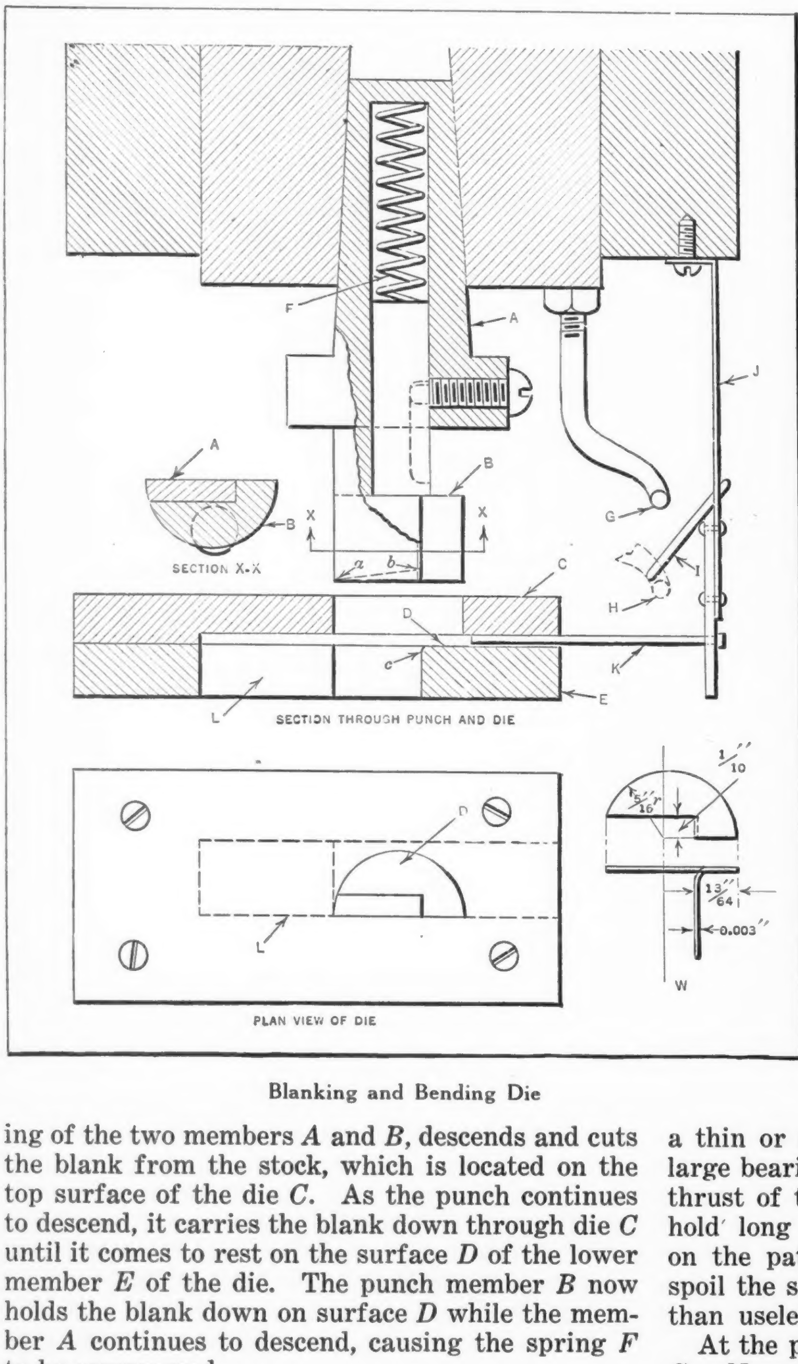


Holder and Tools for Shaping Dies and Keyways

COMBINATION BLANKING AND BENDING DIE

In the accompanying illustration is shown a die that the writer recently built for a foot-operated press having a stroke of 1 inch. The die is used to produce the part shown at *W* in one operation. The platinum stock from which this part is blanked is 0.003 inch thick. Referring to the illustration, it will be noted that the blanked and bent part has the form of a half-disk, 5/8 inch in diameter, with a section 1/10 inch wide and approximately 15/32 inch long, sheared and bent down at right angles to the half-disk section.

When the die is in operation, the punch, consisting of the two members *A* and *B*, descends and cuts the blank from the stock, which is located on the top surface of the die *C*. As the punch continues to descend, it carries the blank down through die *C* until it comes to rest on the surface *D* of the lower member *E* of the die. The punch member *B* now holds the blank down on surface *D* while the member *A* continues to descend, causing the spring *F* to be compressed.



Blanking and Bending Die

As the punch member *A* continues downward, its inner cutting edge, which extends from *a* to *b*, shears the 1/10-inch wide section, and the inner end bends the sheared section down over the rounded end *c* of member *E*. In the meantime, the end *G* of a bent rod secured to the press ram has descended to the position shown at *H*. The angularly positioned piece *I*, which is secured to the flat spring *J*, was forced outward by the end *G* on the down stroke, but snapped back into the position shown.

When the press ram ascends, the end *G*, rising from the position *H*, strikes the under side of piece *I*, causing it to move to the left. This movement carries the pusher *K* to the left, causing it to push the blanked and bent part from surface *D* and far enough to the left to permit it to drop through the die opening *L*.

Newark, N. J. F. H. PARSONS

SECURING RAPPING PLATES TO WOOD PATTERNS

The mutilating of wood patterns by rods and screws employed by the molders in venting, rapping, and drawing the patterns is the cause of frequent complaints. In order to protect the patterns from such abuse, metal rapping plates are attached to the sides. These plates have tapped holes at convenient points in which threaded rods may be inserted. Both the rapping and drawing can then be done through these rods.

It requires some instruction and considerable following up by the foreman to insure that full use is made of rapping plates, but when this is done the lives of the patterns are greatly lengthened. The success of this method depends to a considerable extent on the proper location of the plates. Co-operation with the foundry will insure success in this respect. Granting that the plan referred to is carried out, there still exists a weakness that ultimately leads to the destruction of the pattern. This weakness develops through the loosening of the plates on the pattern. When the plates become loose, the molders will, of course, drop back into their old habits of "rod jabbing."

Plates applied in the conventional manner become loose because they are poorly fitted, insecurely attached, or of insufficient size. Most wood patterns are made of soft wood, on which a thin or small plate does not have a sufficiently large bearing surface to enable it to withstand the thrust of the rapping rod. Wood-screws will not hold long under these conditions. As anything on the pattern that yields or becomes loose will spoil the sand mold, the loosened plates are worse than useless.

At the plant of the Ireland Foundry & Machine Co., Norwich, N. Y., it is the practice to rivet the rapping plates to the patterns. This has eliminated the trouble ordinarily experienced. Patterns thus equipped have been found to be free from broken surfaces after long periods of use. Patterns with metal rapping plates riveted in place will reduce molding costs, because less patching of broken corners and uneven surfaces is required. The expense

for pattern replacements is thus greatly reduced. The practice at the foundry referred to is to use rectangular steel plates instead of rounded ones. The rectangular plates can be fitted by the pattern-maker at less cost and they offer better thrust faces. The plates are made in different thicknesses to suit patterns of various sizes. The plates are always put on in pairs on opposite sides of the patterns. It is thus possible to rivet them securely, making a permanent job, such as would be impossible if only wood-screws were used. There is no danger of breaking the plates by riveting, and the area of the plates is sufficient to prevent them from sinking further into the wood. Tapped holes are also provided in the plates to suit the molder's tools.

Middletown, N. Y. DONALD A. HAMPSON

SPECIAL TOOL EQUIPMENT FOR TURRET LATHE JOB

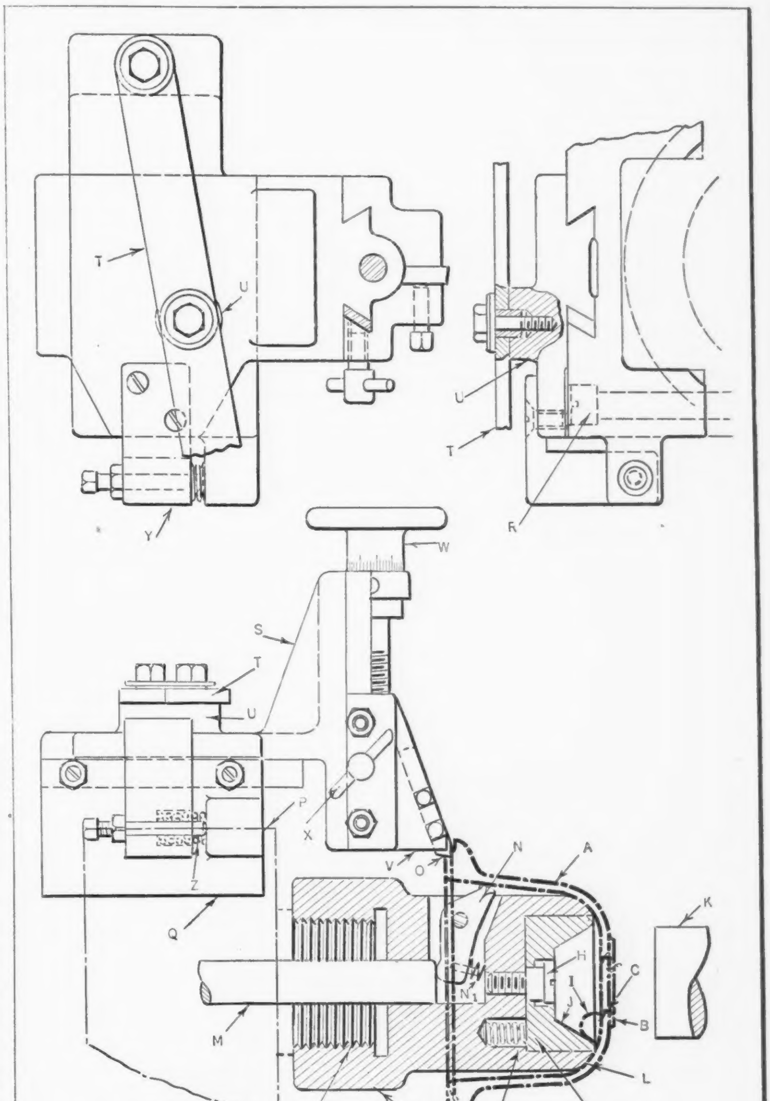
The tool equipment employed in performing an interesting turning operation on a turret lathe is shown in the accompanying illustration. The work consists of machining the brass casting *A*, shown in dot-and-dash lines, as indicated by the finish marks. This casting forms the top casing of a water meter, and was formerly machined in two operations; the first operation was that of finishing the front pad *B* and the hole *C*, after which the casting was turned around and the shoulder *D* machined. With the turret lathe equipped as shown, the casting is finished entirely at one setting.

The body *E* of the chuck which holds the casting is threaded to fit the spindle nose of the lathe. Projecting from body *E* is a hardened ring *F* which is kept under pressure by three springs *G*. The screw *H* serves to restrict or limit the outward movement of ring *F* when the work is removed. The work *A* is pushed over the body *E* until the three equally spaced bosses *I* in the head of the casting strike the tapered surface *J* in ring *F*. At this point the turret is brought forward until the loading rod *K*, which is held in a hole in the turret, strikes the work, thus forcing the ring *F* back against the pressure of springs *G* until the inside wall of the work comes in contact with the chuck body at *L*.

An air valve on the machine (not shown in the illustration) is then operated, which causes the draw-rod *M* to move forward. The end of this rod strikes the curved ends of three equally spaced fingers *N*, causing them to pivot against the action of springs N_1. This causes the ends of the hardened and ground fingers to wedge into the inner wall of the work and hold it securely during the machining operation.

The front pad *B* and hole *C* are next finished with standard turret tools. Then the back shoulder *D*, which is held to close limits, is finished with the tool *O*, held in a tool-slide mounted on the spindle housing. The impossibility of using a cross-slide tool, owing to the closeness of the shoulder to the spindle nose of the machine, made it necessary to provide a tool-holder of this kind. The cap *P* of the front spindle bearing of the lathe was machined to fit the casting *Q*. The cap and the casting *Q* are fastened down on the bearing by screws *R*, which also keep the front bearing cap in place.

The slide *S* fits into a dovetail groove machined in casting *Q*. Fastened to a boss on casting *Q* is the handle *T* by which the slide *S* can be moved back and forth, the handle being fastened to the



Special Chuck and Tool Equipment for Turret Lathe Job

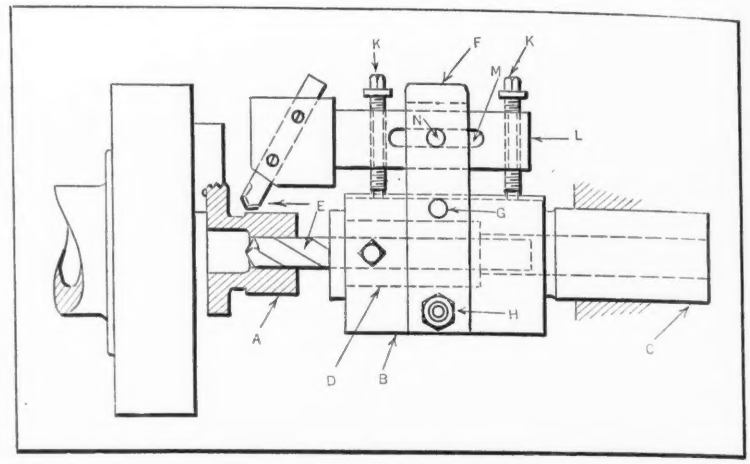
slide by a screw located in boss *U*. The front of slide *S* contains a dovetail slot in which the tool-block *V* is a sliding fit. A gib adjusted by screws insures a good sliding fit for block *V*. It will be noted that the slot for tool *O* is cut at an angle.

The micrometer dial *W*, which is machined on the head of the feed-screw that actuates slide *V*, permits the tool *O* to be accurately adjusted. This feed-screw fits a tapped hole in the tool-block *V*. When the tool is adjusted correctly, the slide is clamped in place by the screw *X*. When handle *T* is moved forward, slide *S* is carried forward, feeding tool *O* ahead, so that it cuts the required shoul-

der on the work. The block Y, secured to slide S, contains an adjusting screw which strikes a projecting stop pad when the required depth of cut is reached. The feeding movement of the slide takes place against the pressure exerted by spring Z.

New York City B. J. STERN

ADJUSTABLE TURNING AND DRILLING TOOL



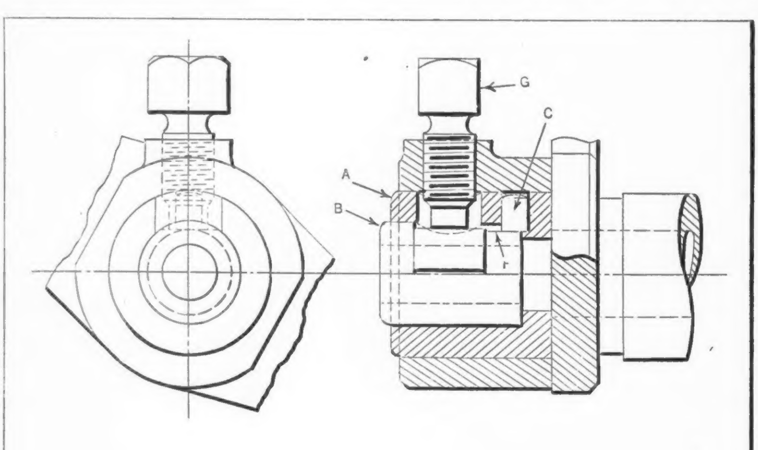
Adjustable Turning and Drilling Tool for Small Work

Combination tools are very useful in turret lathe work of a light variety, if they are made so that they can be adjusted easily and can be adapted to a variety of similar conditions. I recently saw some tools of this kind, made up in several sizes along the lines indicated in the illustration.

In machining the work at A, the outside was to be turned and the center drilled and reamed, as indicated. The tool itself consists of a machine-steel body B, of rectangular section, turned and fitted to the turret hole at C. The center of the holder is drilled out to receive the bushing D, in which the drill E is held. Bushing D is made in various sizes to take different sizes of tools. On the tool body is an inverted U-strap F, which is pinned at G and bolted at H. The top of the holder is slotted along its entire length to act as a guide for the two screws K, the lower ends of which are turned down to the size of the slot. The shank of the holder L is slotted at M to fit the pin N passing through it. The front end of the holder is of square section, slotted to receive 5/16-, 3/8- and 1/2-inch tool bits.

A considerable range of adjustment is possible with this tool, although it will not stand heavy cutting. The method of adjustment is by sliding the holder L backward or forward, tipping it up or down, and adjusting the tool itself within a limited range. The shank L is square, and fits snugly inside the U-strap.

Detroit, Mich. ALBERT A. DOWD



Bushing Adapters for Screw Machine Tools

BUSHING ADAPTERS FOR SCREW MACHINES

In many shops, the expense for bushings for holding internal cutting tools in screw machines is considerable, because of the great number of regular drill, reamer and tap sizes used. As several sizes of screw machines are usually employed in each shop, two or three sizes of bushings having different outside dimensions, but taking the same tools, must generally be provided. This necessitates keeping a large number of bushings on hand.

A good deal of this expense can be avoided through the use of several adapters such as shown in the illustration. They are easily and quickly made, and the only modification in the bushings used in them is the provision of a small flat at the rear end, which can easily be ground in on hardened bushings or milled on the blanks before they are finished. The adapter A is made the same diameter as a standard bushing of the larger machine, but slightly shorter, and is bored to fit the diameter and depth of the bushing B used on the smaller machine, the proportions being such as to bring the smaller bushing center under the clamp screw G in the turret-holder.

A hole through the adapter A admits the point of the clamping screw, and back of this a smaller hole is cross-drilled to receive a hardened locating pin C. This pin is a tight driving fit in A and projects into the bore a short distance. The bushings from the smaller machine are formed with a corresponding flat, which is so made that it will locate the bushing properly and prevent it from turning any appreciable amount. On hardened bushings, this flat is made by grinding the top off the rear end of the bushing, as shown at F, but on new bushings it may be made in the form of a milled groove, as shown at H.

As it is ordinarily desirable to have a bushing either flush with or extending slightly beyond the face of the holder, the use of a holder head ground off as shown in the illustration is advisable, though not absolutely necessary. Small drills and reamers must frequently be used on large products, and for this reason, it is well to have these bushings in sizes that will take bushings two sizes below the regular size, thereby placing all the bushing equipment

of three machines at the disposal of the largest machine.

In addition to the direct saving in equipment, a great deal of time, trouble, and delay can often be avoided by the use of bushing adapters such as described, which greatly increase the flexibility of existing equipment. No matter how many finished bushings may be on hand, the time will come when additional ones will be needed, sometimes merely for the reason that a given job requires several bushings of the same size, as, for instance, in deep-hole drilling.

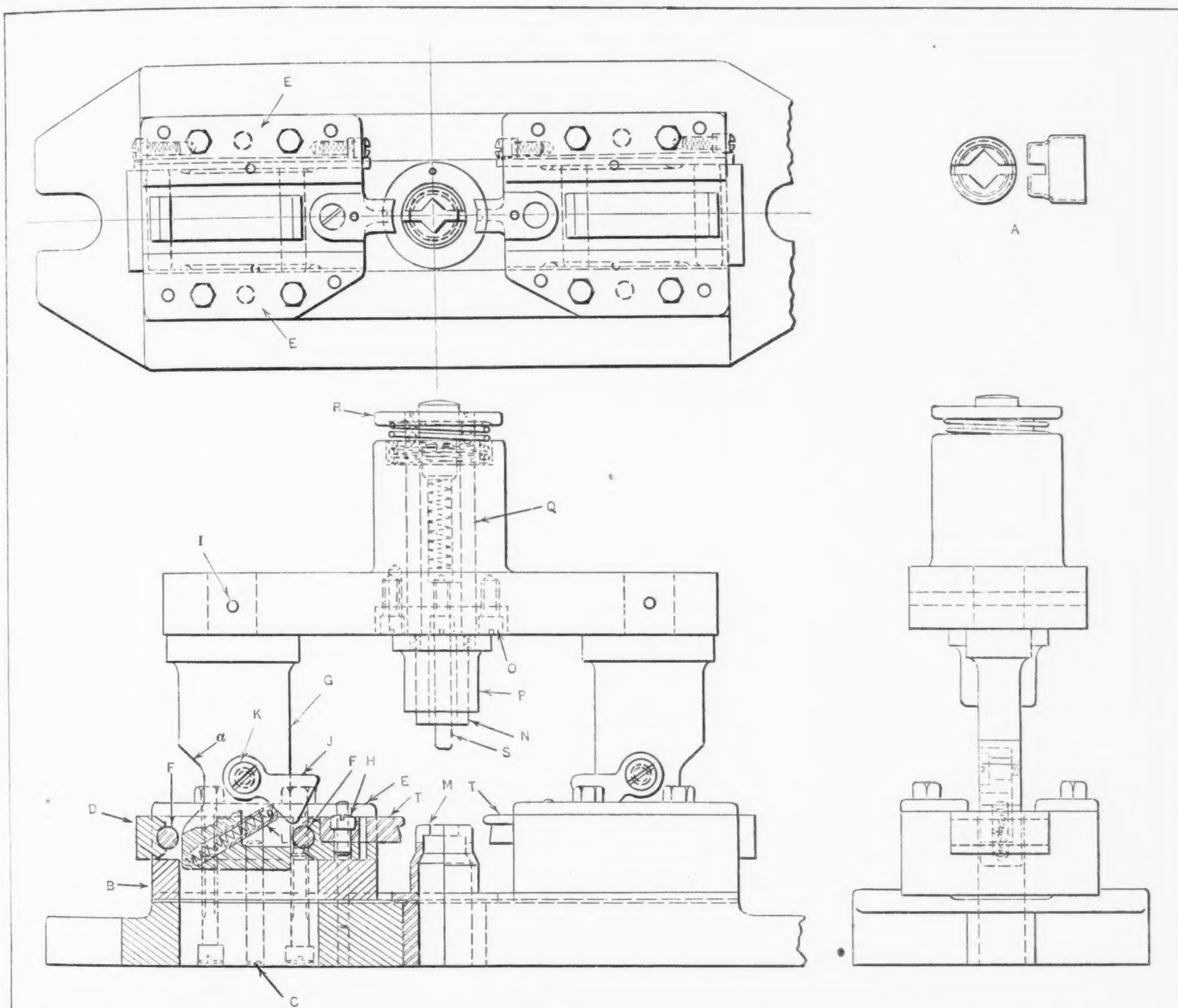
What particularly commends the use of these adapters is the fact that they are not makeshifts in any sense of the word. By placing one of the smaller adapters in a larger adapter, a practically solid unit is formed which will locate the tool as accurately and hold it as securely as a one-piece bushing.

Jena, Germany HENRY SIMON

DIE FOR PIERCING TOP AND SIDES OF BRASS SHELL

The die shown in the accompanying illustration was designed for piercing, in one stroke of the press, the irregular shaped hole extending from the top part way down the sides of the brass shell shown at *A*. Until recently, two dies were required to pierce the shell as shown. As the shells were routed through the factory in large lots, it was considered advisable to construct a die that would complete the piercing operation at one stroke of the press. Besides increasing production, a die of this kind would eliminate one of the troublesome features experienced with the old method, namely that of unevenness in the pierced holes resulting from inadequate means for locating the work during the second operation.

One side of the die is shown in cross-section in the accompanying illustration. As both sides of the die are identical, it will only be necessary to describe the part shown in the cross-sectional view.



Die for Piercing Top and Sides of Brass Shell

The block *B* is secured in the wide slot in the die bed by four machine screws, and is prevented from moving longitudinally by two dowel-pins *C*. The member *D* is a sliding fit in block *B* in which it is confined by the gibs *E*. The two hardened tool-steel pins *F* are a drive fit in the slide *D* and act as bearing surfaces against the cam *G*. Punch *T*, which pierces the side of the shell, is a press fit in slide *D* and is doweled and fastened in place by a screw *H*. Cam *G* is a press fit in the punch-block, where it is secured by the pin *I*.

The hardened steel arm *J* is a swinging fit on the shoulder screw *K* and in the recess cut in cam *G*. This arm is backed up by the spring-actuated plunger *L*. The die *M*, which is a press fit in the

die-block, is shaped to conform to the work and is hollowed out to permit the piercing to drop through. The top piercing punch N is a press fit in the punch-block to which it is secured by screws O. The stripper P is a slide fit on the punch, and has screwed into its flange, four rods Q, which, in turn, are fastened at their upper ends to the cap R by means of fillister-head screws. The compression spring acting between cap R and the shank of the punch-block returns the stripper to its upper position before the piercing operation is commenced. The plunger S slides within the punch and is backed up by a coil spring as shown.

When the press is in operation, the workman places a shell upon the die M and trips the press. On the downward stroke, the arm J will cause the sliding member D to carry the side punch T inward through its action on pin F. This inward movement of the two punches T results in piercing both sides of the shell.

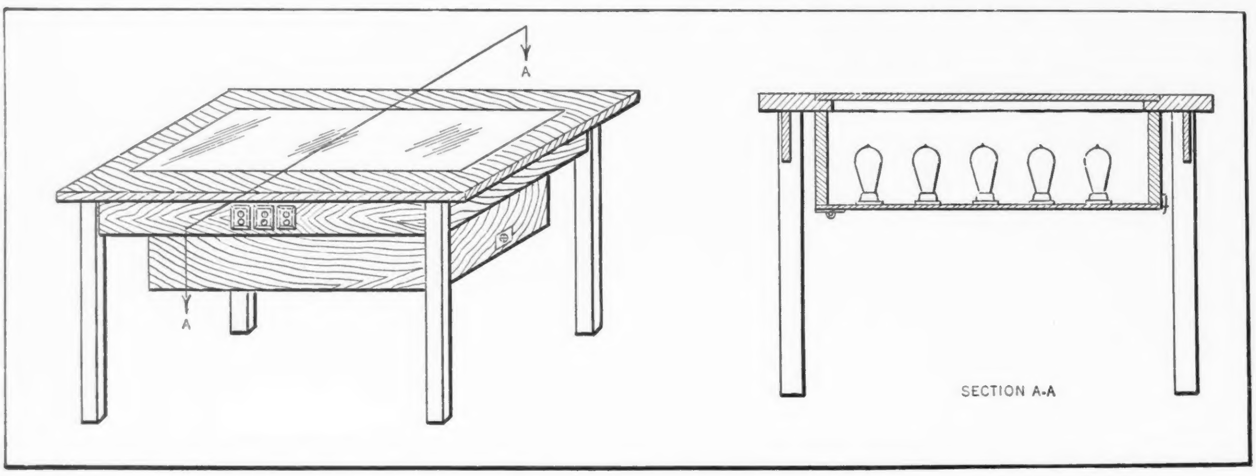
As the punch-block continues to descend, the heel a of cam G acts against the rear pin F, causing the slide D to return, and thus withdrawing the punch T from the die so that it will clear the descending punch N. Punch N, which continues to descend, pierces the square opening that joins the slots in the sides of the shell. The slightly tapered form of the punch N causes it to retain the shell on its return stroke until near the end of the upward movement, at which time it is stripped off through the action of a lever in the gate of the press, which comes in contact with the button on cap R. A stream of compressed air is directed against the shell at this point, forcing it through an opening at the back of the press and into a tote box. A button valve which engages a suitable mechanism with which the press is regularly equipped serves to release the stream of air at the proper time.

The action of the slug or piercing as it is separated from the shell deserves mention. The inclined cutting edges of the punches T have a tendency to curl the piercing, a feature which is desirable in this case. Thus, when the top punch N severs the piercing from the shell, the piercing is doubled up at both ends in a fairly flat condition. Immediately after the top is pierced, the plunger S forces the piercing down through the small bore of the die, after which it either drops down or is forced down through the die by the following piercing. The small projection at the top of punch T prevents the shell from rising while the side is being pierced. By the use of the die described, the production was increased approximately 70 per cent.

Bridgeport, Conn. J. E. Fenno

GLASS-TOP TRACING TABLE

In practically all drafting-rooms, occasions arise when it is necessary to retrace old drawings or vandyke prints that no longer have clear legible lines. Often, in the case of foreign orders or in instances where additional prints cannot be obtained, it is necessary to have several copies of the single blueprint available. In such cases, a tracing is a necessity. The tracing can, of course, be made on an ordinary drafting table by retracing that part which is sufficiently legible to show through the tracing paper and then laying out the remainder of the drawing. A glass-top tracing table, however, will save considerable time and strain on the eyes. Such a table can readily be constructed from an old drafting table.



Glass-top Tracing Table

The table is cut out and routed to take the desired size of glass top. The top should be plate glass, either plain or frosted, depending on whether the electric light bulbs are frosted or plain. The reflector box can be made of any wood available, painted white inside and attached to the top. By attaching this box to the top, the same relative position is assured whether the table top is raised or lowered. The bottom of the box may be hinged to provide access to the light bulbs for replacement if the glass top is set in with putty, or it may be built solid if the top of the glass is beveled and merely set in place. Several holes may be made to provide ventilation.

Three switches on the front of the box serve to control the electric lights, which are connected with the lighting circuit by means of an extension cord plugged into the receptacle on the end of the reflector box. The three switches at the front of the table are so connected that one-third or two-thirds or all of the lights can be thrown on as required. With this arrangement the electric current can be conserved, and the glare reduced. The total number of light bulbs may be varied from four to

ten, depending upon the wattage of the individual bulbs, but a large number of low-watt bulbs will generally give better light distribution. In using the table, a sheet of celluloid may be placed between the glass and the drawing to provide a suitable working surface for compass or divider points. Small drawings or blueprints may be attached to the glass with gummed stickers.

Philadelphia, Pa. FRANK KAHN

CUTTING FLUTES IN SMALL HOLE

The spirally fluted shaft *B* and the crank member *C*, Fig. 1, which is fluted to fit the shaft *B*, are part of the opening and closing mechanism of an automatic screw-cutting die. The diameter of the spiral member is 3/8 inch and the grooves or flutes are cut to a depth of approximately 1/32 inch. The fluted section in member *C*, which engages the flutes on the shaft, is only 1/4 inch long and is located at the left-hand end of the piece, as shown in the split section at *E*. The remaining portion of the bore in part *C* is finished to a diameter of 3/8 inch.

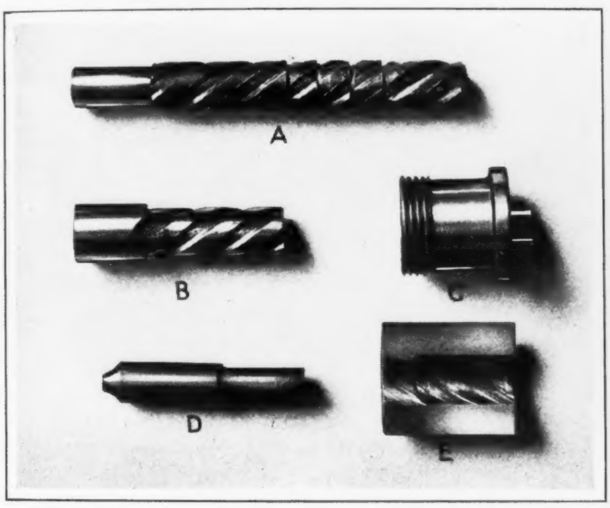


Fig. 1. Small Fluted Pieces and Cutter and Broach Used for Fluting

A good fit of the fluted members is necessary, in order to give the smooth cam action required. The forming of the flutes in member *C* presents an interesting problem. This is accomplished by means of the simple device shown in Fig. 2, which is attached to the ordinary hand-mill. The blanks, as received for this operation, have the hole and clearance bored accurately to size.

The fixture has an indexing head consisting of two major parts, an outer ring *F*, which is slotted for the index-pin *G*, and an inner indexing member *H*, which carries the blank in which the flutes are to be cut. A set-screw in member *H* serves to hold the blank in place. The ring *F* is attached to the spindle *J*, which is actually a square-fluted screw supported in a pair of babbitted boxes. A yoke *K*, clamped to the spindle, is connected with a crank *L* which, in turn, is connected to a flywheel on the cutter-spindle of the hand-mill on which the device is mounted. When the flywheel is set in motion, the arm *K* is rocked back and forth, causing the threaded spindle to alternately advance and return through the babbitted bearings. The required travel or throw of the work-spindle is governed by the radial adjustment of the stud on the flywheel, which is connected with crank *L*.

The crank is also allowed to have a sliding movement on the stud, which corresponds with the endwise travel of the work-spindle. The helical or spiral movement, in combination with the endwise movement, causes the spiral flute to be cut by the tool *D*, Figs. 1 and 2. Tool *D* is carried in the slide *M*, which is given the necessary adjustment for depth of cut by means of the handwheel *N*. The depth to which the flute is cut is gaged by a stop-screw.

After cutting the first thread, the cutter-slide is backed away sufficiently to permit indexing the blank for cutting the next groove or flute. A split or bisected blank is shown in the cutting position at *E*, Fig. 2. The cutter *D* is also shown in the working position. The finished spiral shaft, a crank, and the remaining half of the bisected part previously referred to are shown at *S*, *T*, and *U*, respectively. The cranks receive a final correcting operation with the sizing broach shown at *A*, Fig. 1.

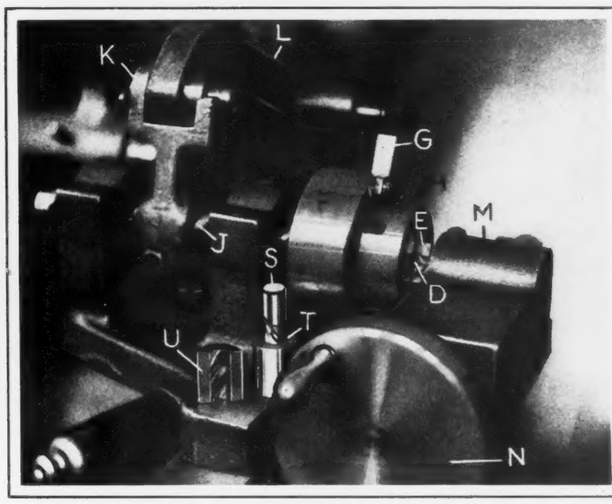


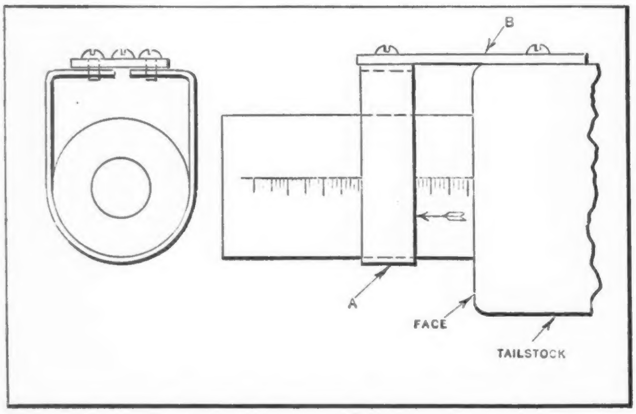
Fig. 2. Device for Cutting Flutes in the Bore of Part C, Fig. 1

Springfield, Vt. O. S. MARSHALL

TAILSTOCK SCALE ATTACHMENT

Recently, while using a back facing tool in the lathe, the writer noticed that it was easier to stop at the proper line on the spindle scale when the tailstock was fed backward than when it was fed forward, because the eye could be easily kept on the scale line as it approached the face of the tailstock. Thus it was easy to see when the correct line reached the face.

When the spindle is fed outward, the graduation line is actually hidden until it reaches the end or face of the tailstock, making it necessary to estimate the position at which the feeding movement should be stopped in order to bring the required graduation mark in line with the face. In order to be able to see the line on the outward feed, which, of course, is the most used, the writer made the attachment shown in the accompanying illustration, which can be easily secured to the tailstock whenever it is needed.



Tailstock Attachment which Facilitates Use of Graduated Scale

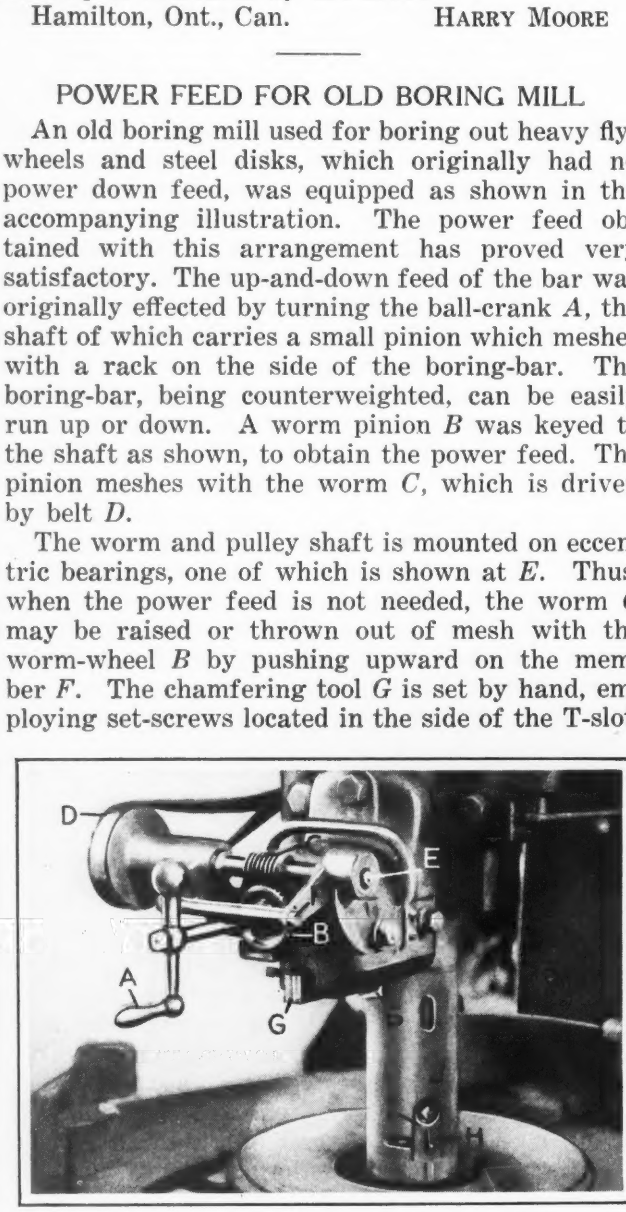
This attachment consists of a piece of strip metal *A* bent to half enclose the spindle, and a strip *B*, secured to the tailstock. Strip *B* serves to support the piece *A*. The ends of piece *A* are bent at right angles, as shown, and secured by screws to the piece *B*. With this arrangement, it is an easy matter to stop the inward feeding movement when the required graduation has reached the side of strip *A* indicated by the arrow.

Hamilton, Ont., Can. HARRY MOORE

POWER FEED FOR OLD BORING MILL

An old boring mill used for boring out heavy flywheels and steel disks, which originally had no power down feed, was equipped as shown in the accompanying illustration. The power feed obtained with this arrangement has proved very satisfactory. The up-and-down feed of the bar was originally effected by turning the ball-crank *A*, the shaft of which carries a small pinion which meshes with a rack on the side of the boring-bar. The boring-bar, being counterweighted, can be easily run up or down. A worm pinion *B* was keyed to the shaft as shown, to obtain the power feed. The pinion meshes with the worm *C*, which is driven by belt *D*.

The worm and pulley shaft is mounted on eccentric bearings, one of which is shown at *E*. Thus, when the power feed is not needed, the worm *C* may be raised or thrown out of mesh with the worm-wheel *B* by pushing upward on the member *F*. The chamfering tool *G* is set by hand, employing set-screws located in the side of the T-slot.



Old Boring Mill Equipped with Power Feed

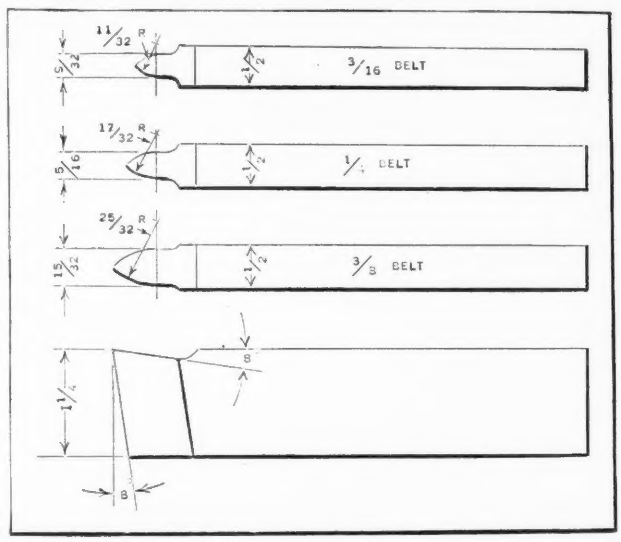
The boring tool *H* is carried in a slide inserted in the spindle at *I*, and is adjusted by means of the screw *J* which is turned with a socket wrench. As the bar does not turn, it is not so difficult to obtain the required cross adjustment as might at first appear, although the operator usually stops the table while adjusting the tool to avoid danger of the wrench being caught on the work or holding fixtures.

Cleveland, Ohio AVERY E. GRANVILLE

PULLEY GROOVING TOOLS FOR ROUND BELTS

The accompanying illustration shows three different sizes of form grooving tools for pulleys for round belts. These shapes have been used for some time and have given quite satisfactory results.

In making grooved pulleys, the outside diameter is finished to size. The grooving tool, suitable for the diameter of belt to be used, is then fed in until



Pulley Grooving Tools

the circumference of the pulley coincides with the center line crossing the nose of the tool from which the radii of the nose is struck. The outer edges of the groove are rounded over with a file.

Rochester, N. Y. EDWARD T. HEARD

STOPPING CRACKS IN SHEET METAL

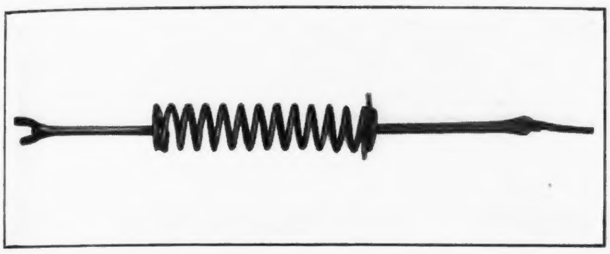
Cracks in sheet-metal parts of a machine start principally as a result of vibration. The continuous bending back and forth of the fibers causes them to crystallize and finally snap. After a very small check has started, it will creep onward until it reaches the edge of the zone of vibration.

A method that has proved effective in stopping such checks from enlarging is to drill a very small hole through the material at the end of the crack. The hole should be so located that at least half of the drill will cut beyond the end of the crack in the solid material. This procedure should be followed even when a patch is placed over the crack; otherwise, the crack will eventually creep beyond the confines of the patch. Welding, however, provides the best means for stopping cracks, as the material is annealed in the welding process and the fibers welded together. C. C. MARK

Shop and Drafting-room Kinks

SPRING EXTENSION CONNECTIONS FOR REPAIR WORK

There is nothing that taxes ingenuity more in repair work than the humble coil spring, for such springs are made in countless sizes, shapes, and lengths. In emergencies, two cotter keys can be used to make a short spring take the place of a longer one until one of the required length can be made or procured. The ends of the keys are bent at right angles or a little less than a right angle with the body of the key, making one bend a little above the other to suit the wind or lead of the spring. The pins are then slipped in place, as shown in the accompanying illustration. The eyes of the keys take the hook connections. The bends in the keys are made at the right point to give the spring tension required.

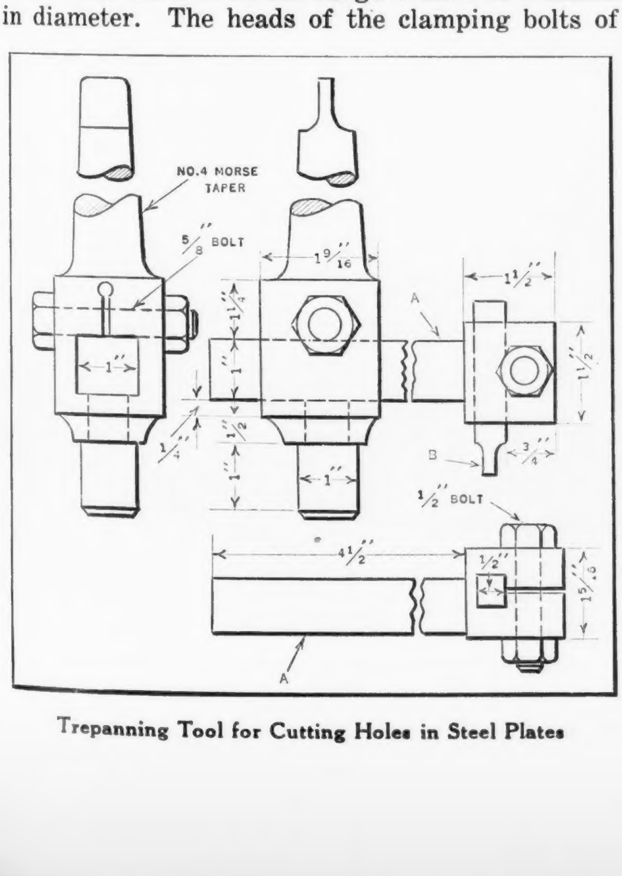


Spring Extension Connections Made from Cotter Pins

Missouri Valley, Iowa FRANK W. BENTLEY, JR.

TREPANNING TOOL

In the accompanying illustration is shown a trepanning tool which the writer designed for use in cutting holes in steel plates up to 1/2 inch in thickness. The holes to be cut range from 2 to 6 inches in diameter. The heads of the clamping bolts of the tool are spot-welded in place, in order to prevent them from turning when tightening the clamping nuts. The cutter-bar *A* is made from chrome-nickel steel, and the cutter *B* can be removed for sharpening without disturbing the setting of the tool. The tool is very strong and is giving excellent results.

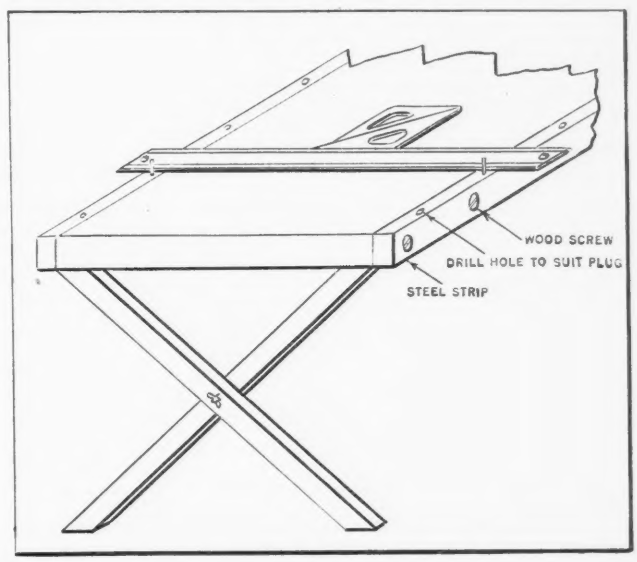


Trepanning Tool for Cutting Holes in Steel Plates

Long Beach, Cal. E. J. JORDAN

POSITIVE BASE LINES ON LARGE DRAFTING BOARDS

On large drafting boards, 5 by 18 feet or larger, the usual practice, when no special equipment is available, is to carefully lay out base lines and then work from them by placing a heavy steel straightedge on them, hoping that it will not accidentally shift. A better method is to take strips of steel, about 1/2 inch in width and equal to the depth of the board, and attach them to the long sides of the board by heavy wood screws. In these steel strips, at intervals of a foot, and exactly opposite each other, are 1/4-inch reamed holes. When these holes have once been accurately determined, inserted plugs form positive locating points for a straightedge. One set of pins is used, being moved about as required. For drawing lines parallel with the straightedge, two triangles are used, as illustrated.



Arrangement for Establishing Positive Base Lines on Large Drawings

Philadelphia, Pa. JOHN F. HARDECKER

* * *

According to the research department of the American Automobile Association, the total investment in highway transportation is greater than in railroad transportation in the United States. The highway transportation system, including motor vehicles as well as highways, represents an investment of approximately $26,500,000,000. The investment in the steam railroads is estimated at $23,050,000,000.

Questions and Answers

DEFECTIVE MACHINERY

J. C. B.—To whom may an employe report a defective condition in a machine, so that the employer becomes responsible?

Answered by Leo T. Parker, Attorney at Law, Cincinnati, Ohio

For the employer to be liable for accidents under these circumstances, it is necessary that the employe give notice to the employer himself, or to any other person who acts as his authorized agent. For instance, if one employe requests another employe to make repairs, and neither workman has control over the other, such notification is not a legal notice to the employer. The notice must be given to a foreman or some other person who is duly authorized to act as an agent of the employer, and who has control over the workman who imparts the information.

It is important to know that an employer is not responsible under all circumstances, even where he or his duly authorized agent promises to have repairs made and fails to do so, as a result of which the workman is injured. This is particularly true if it can be proved that the workman failed to exercise ordinary care in protecting himself against injury. Furthermore, the Courts consistently hold that an employe who is operating a defective machine is bound to exercise a much higher degree of care to protect himself against injury than when he operates a machine without defective parts.

AUTHORITY FOR SCREW THREAD STANDARDS

L. M. S.—In MACHINERY'S HANDBOOK, sixth edition, page 1149, the table of U. S. standard threads gives the number of threads per inch for sizes below 1/4 inch and also for 11/16, 13/16, and 15/16 inch. Many tables do not give these sizes as U. S. standard. What is the authority for the numbers of threads given for these sizes and are they accepted as U. S. standard?

A.—The Sellers screw thread system devised by William Sellers, which was recommended for adoption by a committee of the Franklin Institute in 1864 and received the approval of the Secretary of the Navy, May 9, 1868, is known as the United States standard. The original system, as approved by the Franklin Institute and the Secretary of the Navy, did not include the sizes below 1/4 inch nor the sizes 11/16, 13/16, and 15/16 inch, but these were later accepted by the engineering field as part of the system, and have been in common use for over forty years.

While, according to the empirical formula constructed by William Sellers for determining the number of threads for any required diameter of screw or bolt, the numbers of threads for 11/16-, 13/16-, and 15/16-inch screws should be 10, 9 and 8, respectively, instead of 11, 10 and 9, as given in the HANDBOOK, screws and bolts of the sizes and with the numbers of threads specified in MACHINERY'S HANDBOOK have been regularly made for over forty years, and are therefore generally accepted as U. S. standard.

The sizes below 1/4 inch, in MACHINERY'S HANDBOOK, have also been generally accepted as U. S. standard for many years and are given in a book entitled "Standards of Length and Their Practical Application," edited by George M. Bond and published by the Pratt & Whitney Co., Hartford, Conn., in 1887. This book is probably the best authority on the origin and development of the U. S. standard screw thread system.

MECHANICAL EFFICIENCY

M. N.—Mechanical efficiency ordinarily is defined as the ratio of output to input, but does this take into account *all* losses? In other words, is mechanical efficiency based upon the relation between losses and the total amount of energy supplied?

A.—If E represents the energy that a machine transforms into useful work or delivers at the driven end, and L equals the energy lost through friction or dissipated in other ways, then:

$$\text{Mechanical Efficiency} = \frac{E}{E + L}$$

In this case, the total energy $E + L$ is assumed to be the amount that is transformed into useful and useless work. The actual total amount of energy, however, may be considerably larger than the amount represented by $E + L$. For example, in a steam engine there are heat losses due to radiation and steam condensation, and considerable heat energy supplied to an internal combustion engine is dissipated either through the cooling water or direct to the atmosphere. In other classes of mechanical and electrical machinery, the total energy is much larger than that represented by the amount transformed into useful and useless work. If E_1 equals the full amount of energy or the true total, then:

$$\text{Absolute Efficiency} = \frac{E}{E_1}$$

It is evident that the absolute efficiency of a prime mover, such as a steam or gas engine, will be much lower than the mechanical efficiency. Ordinarily, the term efficiency, as applied to engines and other classes of machinery, means the mechanical efficiency. The brake horsepower of a steam engine or energy delivered to the flywheel, divided by the indicated horsepower or work done in the steam cylinder (as shown by an indicator card) equals the mechanical efficiency. This efficiency should be determined at full load. In the case of manufacturing machinery, the energy available at the driven or working end divided by the energy supplied to the initial driving shaft equals the mechanical efficiency.

Machining a Ball Seat on a Turret Lathe

By B. J. STERN

THE complete machining of a ball seat on a turret lathe was accomplished by the use of the special but simple turret tools shown in Figs. 2 to 4. The ball seat, Fig. 1, is a brass casting which, in use, is pressed into a large casting. The ball seat casting is first chucked on the rough diameter *A*, and the diameter *B* is then turned and face *C* faced. The set-up for these operations is in accordance with the usual practice. Next, the casting is turned around and gripped on the finished diameter *B* in a Barker wrenchless chuck, in a turret lathe. It is located in the chuck by the finished face *C*, which strikes a stop, thus insuring a uniform location for all castings. Diameter *A* is then roughed and finished to a sharp corner on shoulder *B*, as indicated by dimension *D*. The roughing tool is also used to cut the chamfer *E*. After this, the ball seat *R* is machined, and finally the taper behind the ball seat is turned to the dimension *F*.

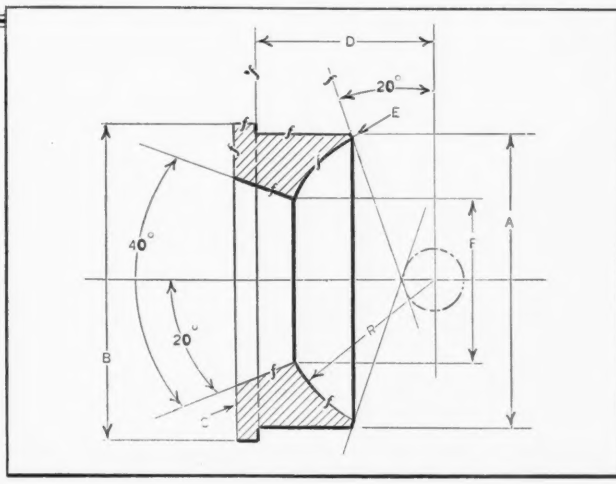


Fig. 1. Ball Seat Machined with the Tooling Equipment Shown in Figs. 2 to 4

The tool arrangement shown in Fig. 2 is used for roughing diameter *A*, Fig. 1, and finishing chamfer *E*. The tool bit *A*, Fig. 2, is held tangent

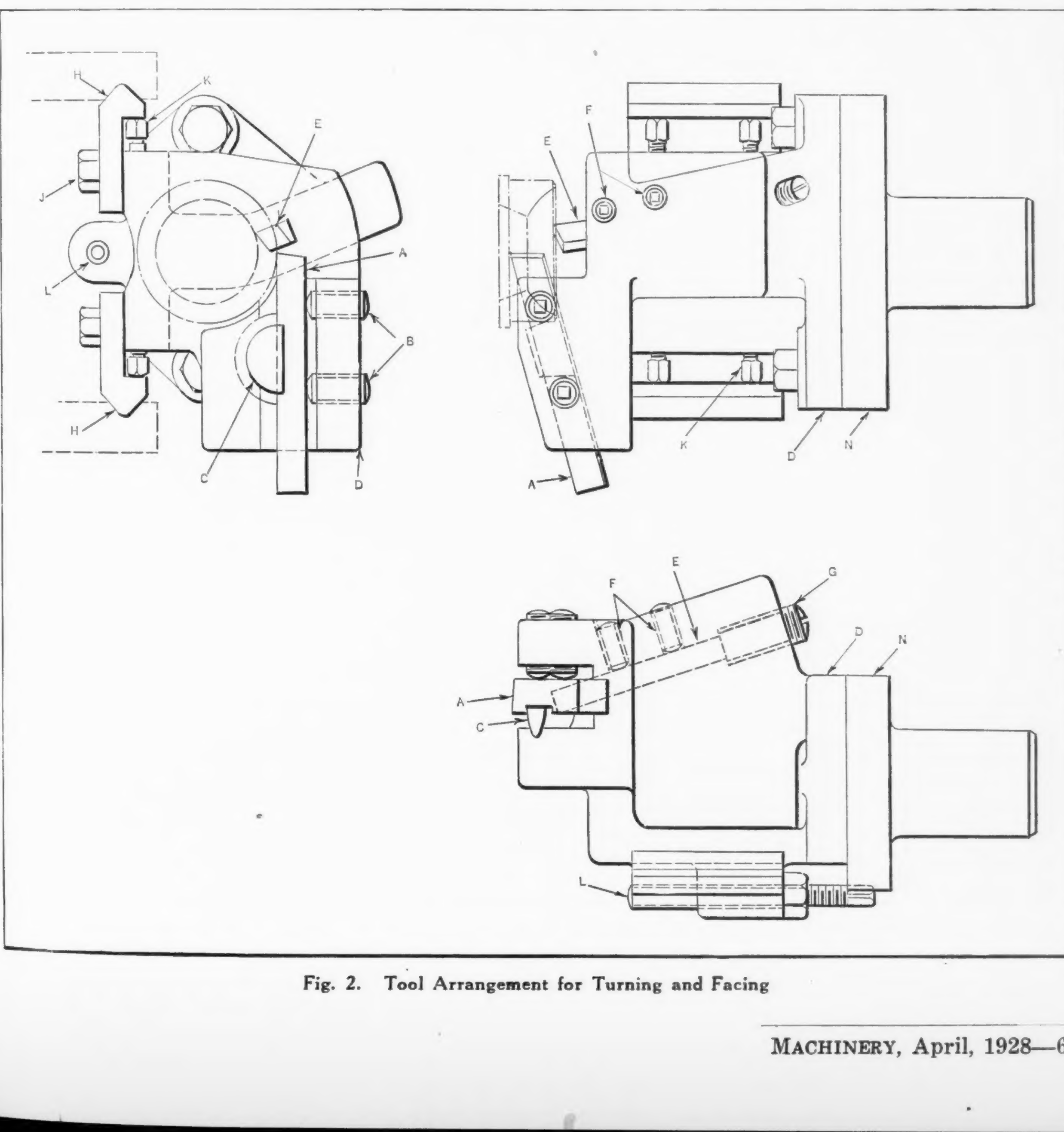


Fig. 2. Tool Arrangement for Turning and Facing

to the circumference to be finished and is clamped by the set-screws *B* in a seat in the hardened rocker *C* which fits a seat in the cast-iron bracket *D*. The cutting edge of this tool can be slightly adjusted by loosening one clamping screw and tightening the other, thus rocking the tool bit. Another tool bit *E* fits a slot cut in the bracket *D* at the proper angle for chamfering the edge of the work. The second tool bit is clamped in place by the set-screws *F*, and can be adjusted longitudinally by the screw *G*.

To the bottom of bracket *D* adjustable vee guides *H* are clamped by screws *J* which pass through elongated clearance holes in these guides. These a turning fit in the hardened and ground bushings *F*. These bushings are driven into the bracket *G* and the cast-iron bracket cap *H*. When the cap is screwed by screws *J* to the bracket, it forms a housing for the worm sector *C* and the worm *K*. This worm is keyed to and is driven by the shaft *L*, which is a running fit in the bushings *M* that are driven into the complete housing, as shown. The thrust on the worm is taken up by the bronze washers *N*, the worm and washers fitting between two finished pads *O* in the housing. The shaft *L* is pinned to the handwheel *P*.

It will be noted that the worm and housing assembly are pitched at a 30-degree angle to the hori-

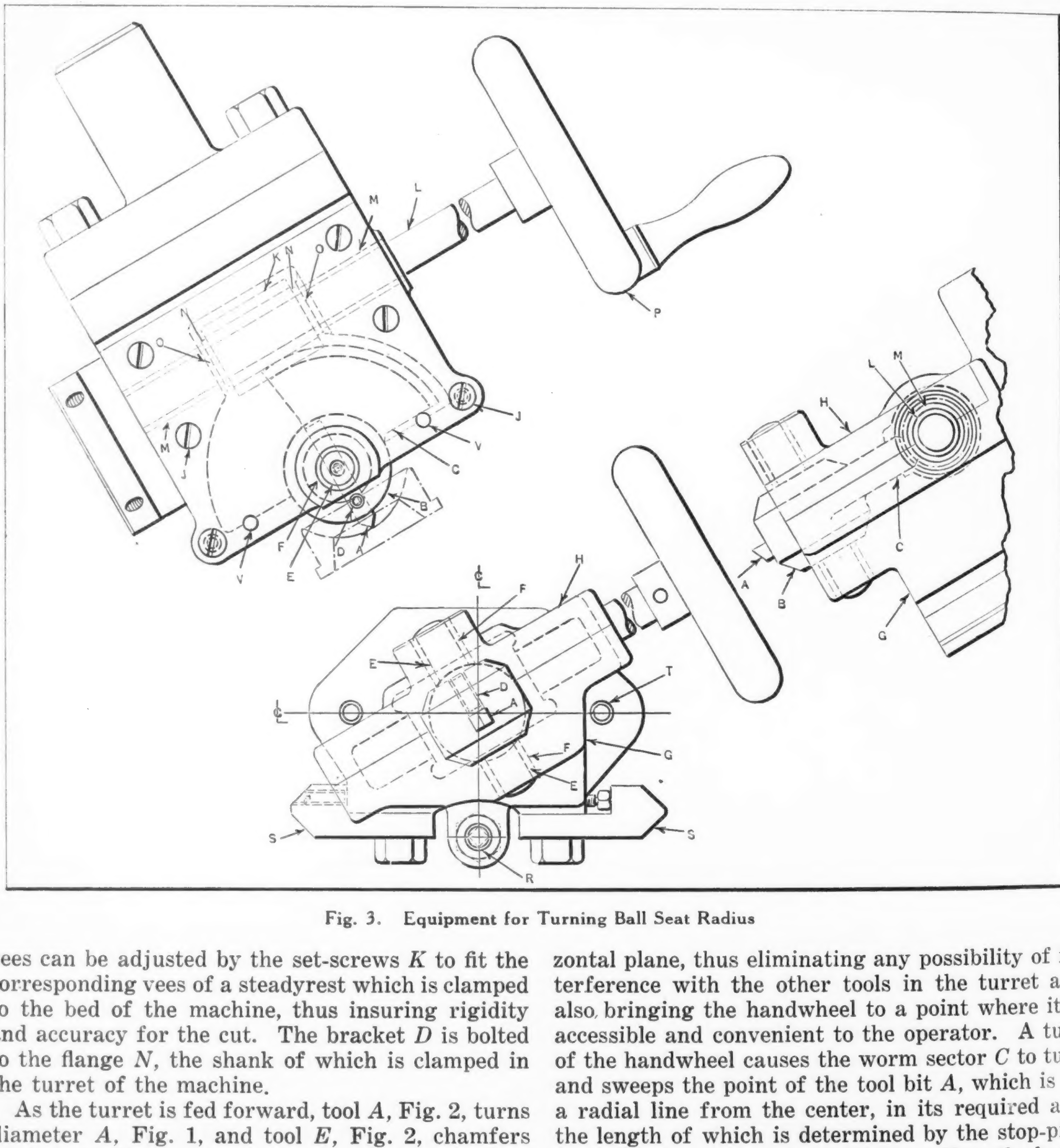


Fig. 3. Equipment for Turning Ball Seat Radius

vees can be adjusted by the set-screws *K* to fit the corresponding vees of a steadyrest which is clamped to the bed of the machine, thus insuring rigidity and accuracy for the cut. The bracket *D* is bolted to the flange *N*, the shank of which is clamped in the turret of the machine.

As the turret is fed forward, tool *A*, Fig. 2, turns diameter *A*, Fig. 1, and tool *E*, Fig. 2, chamfers surface *E*, Fig. 1, adjustable stop *L*, Fig. 2, determining the length of cut.

The ball seat radius *R*, Fig. 1, is finished by the sweep tool shown in Fig. 3. The tool bit *A* fits a slot cut in the hub *B* of the worm-gear sector *C*, and is clamped in place by the set-screws *D*. On the hub *B* are two round projections *E* which are zontal plane, thus eliminating any possibility of interference with the other tools in the turret and also bringing the handwheel to a point where it is accessible and convenient to the operator. A turn of the handwheel causes the worm sector *C* to turn and sweeps the point of the tool bit *A*, which is on a radial line from the center, in its required arc, the length of which is determined by the stop-pins *V* which also serve to locate the cap *H* on the housing. The radius of this sweep is determined by the distance from the point of the tool to the center of the worm sector.

The location of the tool with regard to the work is determined by the adjustable stop *R*, which is carried in a lug at the bottom of the housing bracket.

This stop is located so as to strike a hardened plate on the steadyrest previously mentioned. The adjustable vee guides *S* are bolted to the bottom of the bracket in the same manner as the tool shown in Fig. 2, fitting the same steadyrest.

The final operation, that of cutting the taper behind the ball seat, is performed by the tool shown in Fig. 4. The tool bit *A* fits a slot in the rounded nose *B* of the tool carriage *C*. The slot is wider than the tool, allowing the tool bit to be clamped by the screws *E* upon the rocker pin *D*. Screw *L* at the back of this slot adjusts the tool bit as desired. The tool carriage *C* is dovetailed to fit a slot that is cut at a 20-degree angle to the horizontal plane in the floating carriage guide *F*. This carriage guide rides on two shouldered studs *G* that are driven into the bracket *H* and further secured by the set-screws *J*, the head of the stud serving to limit its forward travel. A strong spring *K* inserted in a hole bored in carriage guide *F* keeps the carriage guide and the bracket *H* apart.

The tool carriage *C*, which is a nice sliding fit in the carriage guide, is held in a definite relation to bracket *H* by a hardened and ground bushing *M* which is a sliding fit in a slot *N* cut in the bottom of the tool carriage. This bushing is fastened to bracket *H* by screw *L*. A lug *O* at the bottom of the carriage guide carries the adjustable stop *P*. Bolted to the bottom of the carriage guide are adjustable vees *S* similar to the ones previously described. The entire arrangement is bolted to the flange *R*, the shank of which is clamped in the machine turret.

In operation, the machine turret is advanced, the floating carriage guide and bracket acting as one part. The guides *S* enter the vees in the steadyrest until stop *P* strikes a hardened plate on the steadyrest. At this point the tool bit *A* is about ready to start its cut, being set to give the proper diameter *F*, Fig. 1. When the turret is advanced further, the carriage guide is pushed back against the pressure of spring *K*, and the tool carriage *C* is forced by bushing *M* to advance by sliding in the dovetail of the now stationary carriage guide. This carries the tool bit *A* with it, so that the taper is cut at the proper angle behind the ball seat.

* * *

According to a booklet, "Economic Statistics of the Soviet Union," published by the Amtorg Trading Corporation, New York City, the industrial output of the Soviet Union is at present 10 per cent greater than in 1913. The value of the agricultural production for 1927, according to the same source, was only 1 per cent below that for 1913. The iron and steel industry, however, is still lagging behind, but the production of machinery, and especially of agricultural implements, is said to be greater than before the war. Eleven thousand miles have been added to the Russian railway lines since the war, and the tonnage carried is said to be 20 per cent greater than in 1913. The public utility plants produced in 1927 three times the energy produced in 1913. The building of some very large hydroelectric power stations has been one of the most noteworthy developments in the engineering field in the Soviet Union.

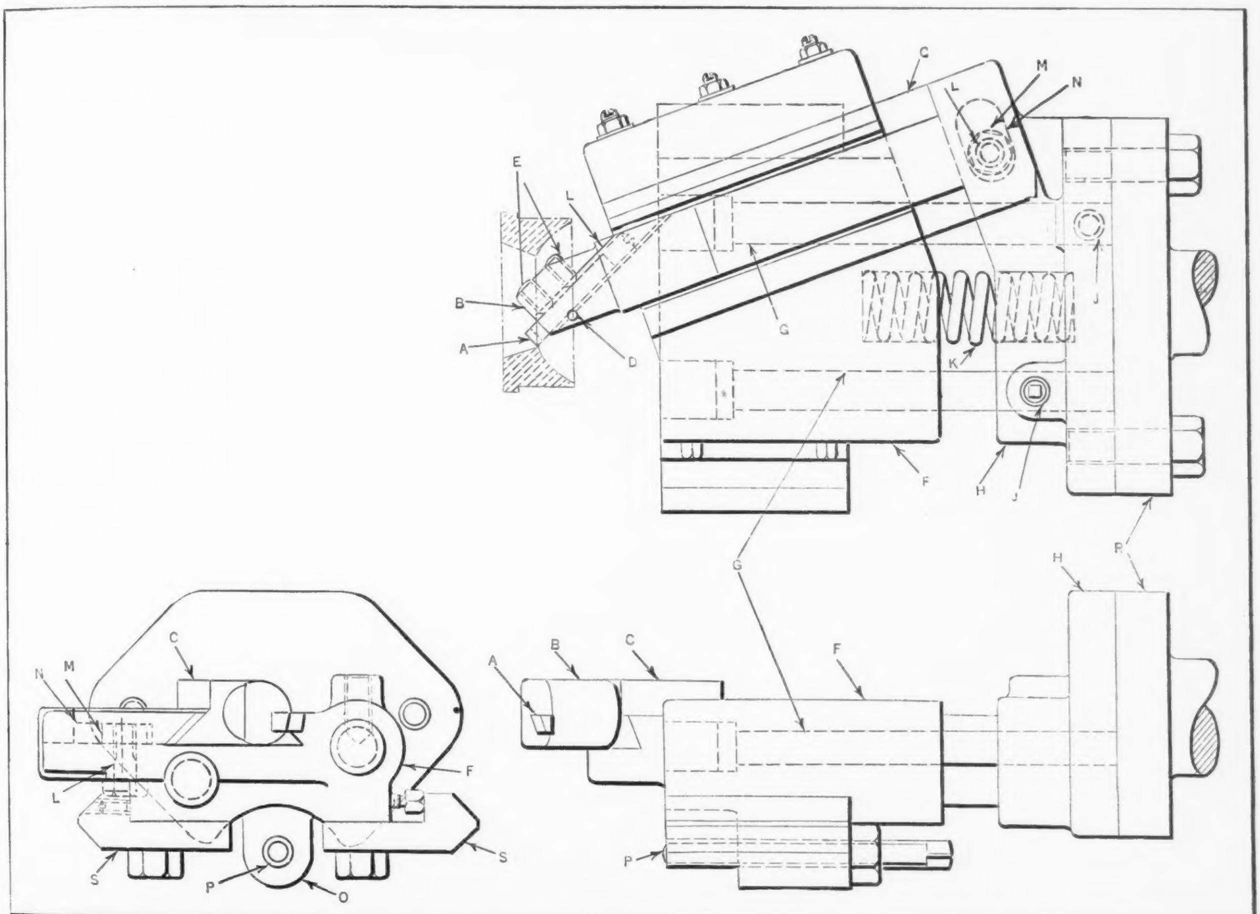


Fig. 4. Turret Tool Used for Turning Reverse Taper

BAKELITE AND HOW IT IS MACHINED

By PETER HAGEN

Although bakelite is a component part of many products, such as varnishes, lacquers, enamels, cements, and molded parts, the term is applied by men in the shop chiefly to one of its forms, namely, laminated bakelite. This is the synthetic condensation product, which in the form of laminated sheets, rods, and bars is now in many cases replacing wood, fiber, porcelain, mica, rubber, and metals. It is sold in different grades under the following trade names: "Celeron," "Formica," "Fibroc," "Textolite," "Dilecto," "Micarta," "Phenolite," and "Spaulding Bakelite."

By a special process, carbolic acid and formaldehyde are caused to react to form a resin-like material which is both soluble and fusible but which has the unique property of becoming insoluble, infusible, and very hard, strong, and resistant after being subjected to heat. Certain grades of paper and fabric processed with this resin-like raw material create the laminated product known as bakelite.

Properties of Bakelite

Bakelite is non-hygroscopic, tough, strong, and resilient. It is resistant to heat, cold, acids, chemicals, oils, fumes, and high electrical voltage. As it is chemically inert, it does not deteriorate with age. Being a laboratory product, it is uniform and can be held to a given standard for any particular purpose.

Bakelite is light in weight; yet moisture and constant handling with oily or grease-stained fingers cannot warp or mar it. Its colors are permanent and will not fade. Its resistance to heat, cold, rain, ice, snow, and salt air make it ideal for electrical insulation. It resists wear well and makes silent contacts when used in moving parts. As a dielectric it does not deteriorate with age. Its strength permits manufactured parts to be made thin, thus reducing the clearance that might otherwise be required.

How Bakelite is Machined

Unless a product can be worked and machined in the shop by the mechanic, its usefulness is seriously affected, no matter how desirable its properties. Bakelite may be machined in the shop like metals, provided, of course, that some degree of special skill is employed. A knowledge of the properties of the various bakelite materials, such as can be gained only by experience, is naturally required in order to achieve the best results. This is true, however, of practically all new materials that come into the industrial field.

Method of Turning

Bakelite may be set up in the lathe in the same manner as metals, except that reasonable care should be taken in clamping bakelite tubing in a chuck in order to prevent cracking, as it is more brittle than most metals. No lubrication should be used, and whenever possible, bakelite should be turned to size in a single cut. In any case, the finishing cut should remove at least 1/8 inch of material, because it is more difficult to maintain a uniform diameter when a lighter cut is taken. The material should be turned at a peripheral speed approximately 25 per cent higher than that used for cast iron. It is best to use a wide-nosed tool and employ a coarse feed. The tool should have a large clearance but no rake. It will become dull quickly, and should be sharpened frequently.

Practice in Drilling

The drilling of bakelite should be done with high-carbon steel drills and without the use of any lubricant. A fast feed should be employed. To insure a clean hole on the under side, it is well to clamp the sheet of bakelite to a wood board at the point where the hole breaks through. If the drill is properly ground, the hole will be true and smooth, but slightly under size. If the hole must be the same size as the drill, the drill should be ground slightly off center.

In order to prevent excessive heating of the drill, it should be withdrawn quickly. Ordinarily a drill can be used for about one-half hour before regrinding is necessary. While an ordinary countersink may be used, a modified drill can be employed to better advantage, as it can be resharpened more easily. The drill should be ground to the proper angle for countersinking and should have very little clearance.

Sawing Bakelite

Hacksaws may be used for cutting bakelite, the same as any metal. In using band or circular saws, the same speeds as are used for hard woods or fiber should be employed. It is necessary to sharpen and reset the saws frequently when cutting bakelite. When an exact cut-out of irregular outline is to be removed from a heavy sheet of bakelite, the procedure followed in making small metal templets may be used to advantage, in preference to sawing. This consists of scribing the outline on the sheet material, drilling successive holes which are closely spaced just outside the outline, and then breaking out the material between the holes with a wood chisel. The part is then finished to the exact outline with a hand file or a filing machine. On thin material a coping saw can be used. Usually the saw will be good for only one cut-out.

Punching Bakelite

Punching is the most difficult of the machining operations performed on bakelite. A plain punch and die may be used on sheets or tubes cut to 1/8 inch thick, but smooth edges cannot be obtained on a thickness greater than 1/16 inch. Dies must be kept sharp, and there must be minimum clearance between the punch and die. A little oil can be used on the material or grease can be applied to the punch. To obtain the best results, the material should be heated thoroughly and uniformly in an oven or on a steam table to a temperature of 280 degrees F., preparatory to the punching operation. Sheets over 1/8 inch in thickness and up to 3/8 inch should be blanked and then finished in a shaping die. The sheets should be heated and oiled before blanking is attempted.

Threading and Milling

Threading is a very simple operation, ordinary taps and dies being suitable for this work. For these operations, lubricant can be used in the same

way as on metal. In milling bakelite, high speeds and coarse feeds should be used, so that the cutter throws the chips away from the work. If possible, all the material should be removed with one cut. The use of a lubricant is not necessary.

Polishing Bakelite

Although the original finish on bakelite is a form of varnish, the finish on the machined parts resembles the varnish finish quite closely. If uniformity is particularly desirable, a velvety finish may be obtained by using coarse sandpaper, followed by fine sandpaper and oil.

In machining or working bakelite, patience is necessary. Don't expect to work a new material for the first time with the degree of success attained with materials on which you have had years of experience. If the desired results are not obtained, search for the cause and avoid the same difficulty on the next trial. The methods employed by different companies in machining bakelite vary somewhat. Additional information regarding the machining of "Micarta" and "Formica" is given in the Questions and Answers section of May, 1926, MACHINERY, page 738, under the title "Machining Non-metallic Gears."

* * *

INDUSTRIAL CONDITIONS IN GERMANY AND FRANCE

"Germany gives one the impression of a nation determined to reestablish itself in the industrial world and working resolutely and intelligently to that end," says R. B. Luchars, vice-president of The Industrial Press, publishers of MACHINERY, who recently visited several of the important industrial countries in Europe. He further states that if past accomplishment is the best indication of ability, it is significant that although the Treaty of Versailles deprived Germany of 36 per cent of her steel-producing capacity, the output has now reached 95 per cent of the total tonnage in 1913.

Barring political upsets, it is only a question of time for the total industrial recovery of Germany to be accomplished, and there is every reason to suppose that the German market will be one of increasing importance to American manufacturers. In some ways, however, it is the most difficult of the European markets.

There are several reasons why German manufacturers do not buy more American machine tools and equipment, but perhaps the most serious difficulty is lack of capital. Interest rates vary from 8 to 11 per cent, depending on the nature of the transaction, the top figure being by no means exceptional. Credit accommodation for more than three months is so difficult to get that it is a practical impossibility for the average concern.

Taxes run to a high figure. Every company must pay 23 per cent or more for what are called social taxes—unemployment insurance, compensation insurance, and other items having to do with their employes. Income taxes range from 10 to 60 per cent, the combined result bringing the level of taxation to a point that seriously curtails purchasing power.

The lower scale of living which is unquestionably imposed on the mass of the German people, while making for economy, has also a retarding effect on industrial recovery. Articles of convenience and luxury which are regarded in this country as household necessities are rarely bought by the average German family, the result being that the domestic market is considerably restricted.

German tools can be bought at a price very much lower than the corresponding American product, in most cases. Under existing conditions this obviously must operate greatly to the disadvantage of American products.

The French machinery industry at present is operating at a somewhat reduced rate of activity, due, in part, to the reaction and necessary adjustments which followed the establishment of the franc at its present level of comparative stability. The prevailing uncertainty about future political developments has also contributed largely to this condition. Business men are naturally hesitant about committing themselves to large programs, the success of which would be jeopardized by the return to power of the radical element.

Shortage of capital and high money rates impose a heavy burden, which naturally slows up industrial activity and keeps the buying of new equipment down to the minimum, especially where it concerns the purchase of high-priced American products. Added to this is the high tax rate, which operates directly to reduce the buying capacity of the French nation as a whole.

* * *

PROTECTIVE VALUE OF CHROMIUM PLATE

In view of the great interest at the present time in chromium plating, the paper presented before the annual meeting of the Society of Automotive Engineers by Edwin M. Baker, assistant professor of chemical engineering at the University of Michigan, Ann Arbor, Mich., and Walter L. Pinner of the C. G. Spring & Bumper Co., Detroit, Mich., has attracted unusual attention.

This paper is restricted in scope to a study of the rust resistance afforded by electro-deposited coatings of chromium alone, and of chromium in combination with nickel and copper coatings. The appearance value of a chromium surface is well established, but according to the findings of the authors of this paper, chromium alone has little protective value for outdoor exposure. It is stated, on the basis of careful experiments, that the protective value of a composite coating depends largely on the protection afforded by the underlying coats.

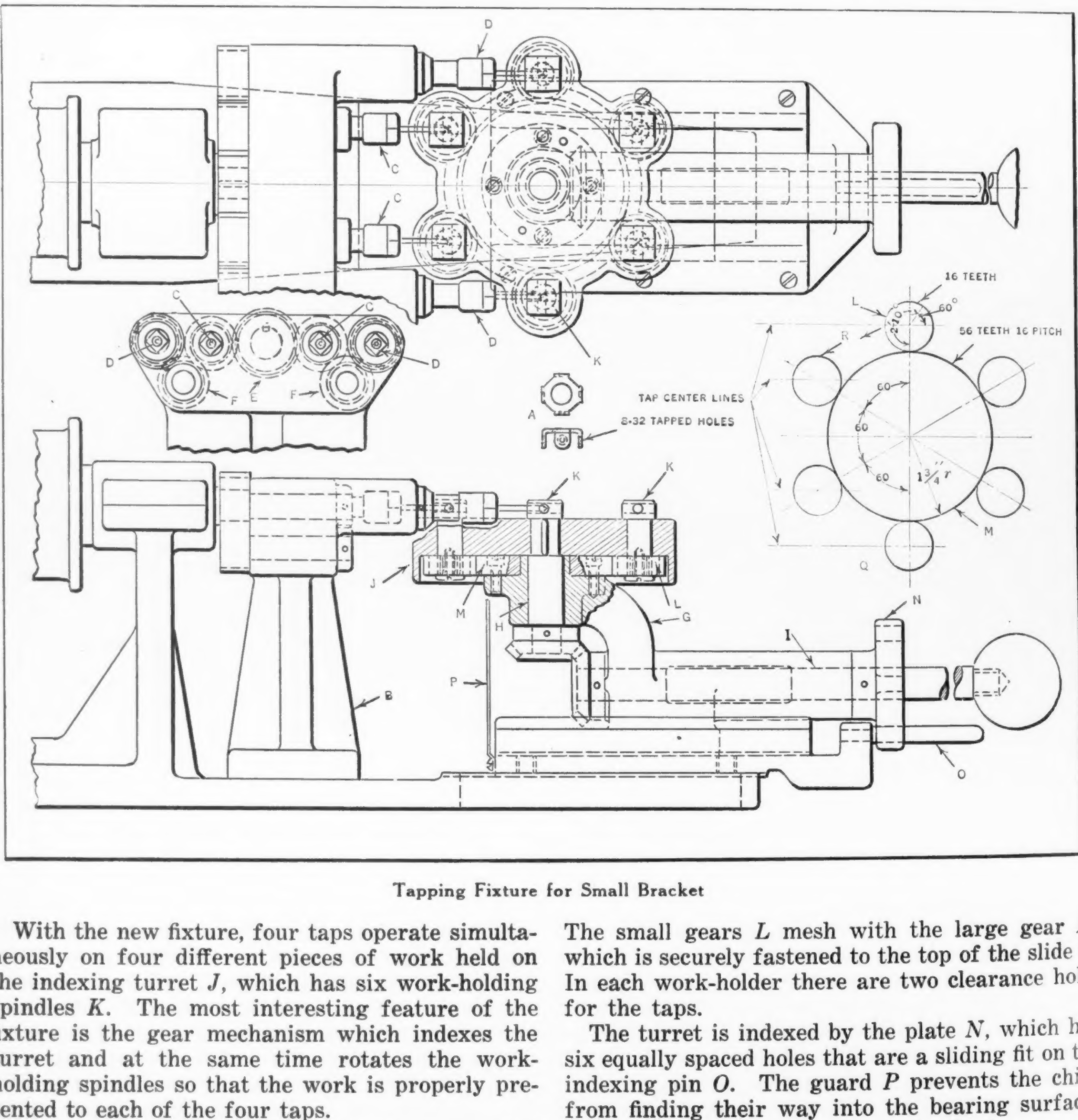
Increasing the amount of chromium deposited on nickel and copper, up to a thickness of 0.00001 to 0.00002 inch, increases the protective value, but a further increase of thickness up to 0.00027 inch of chromium decreases the protective value to almost the result obtained with no chromium. These conclusions are supported by data presented in tabular and graphic forms, and indicate the proper procedures to obtain maximum protective value at minimum cost. There is no question as to the advantages of chromium plate in many fields, but more definite information on its properties is evidently to be desired. Those interested in the complete paper should communicate with the Society of Automotive Engineers, 29 W. 39th St., New York.

Multiple-spindle Tapping Fixture

By JOSEPH E. FENNO

THE fixture and tapping head here illustrated are used for tapping the four holes in the steel cam bracket shown at *A*. These brackets are a component part of an electric light display switch. The fixture is used on a standard tapping machine, and was designed to meet higher production requirements than could be obtained under the old method of tapping one hole at a time.

The member *G* is a sliding fit in the gibbed slot in the base of the fixture. The shafts *H* and *I* are fitted with miter gears, which are kept in mesh, as indicated in the illustration. The turret *J*, which is keyed to the shaft *H*, has six work-holding spindles *K* which are running fits in the turret. At the bottom end of each holder *K* is a small gear *L*, which is secured to the shaft by a machine screw.



Tapping Fixture for Small Bracket

With the new fixture, four taps operate simultaneously on four different pieces of work held on the indexing turret *J*, which has six work-holding spindles *K*. The most interesting feature of the fixture is the gear mechanism which indexes the turret and at the same time rotates the work-holding spindles so that the work is properly presented to each of the four taps.

The revolving tap chucks *C* and *D* are mounted on the ends of their respective pinion shafts which run in suitable bearings in the tapping head. The pinion shafts are driven by the gear *E*, which is keyed to the end of the machine spindle as indicated. The gears *F* act as idlers, serving to drive the tapping chucks in the required direction.

The small gears *L* mesh with the large gear *M*, which is securely fastened to the top of the slide *G*. In each work-holder there are two clearance holes for the taps.

The turret is indexed by the plate *N*, which has six equally spaced holes that are a sliding fit on the indexing pin *O*. The guard *P* prevents the chips from finding their way into the bearing surfaces and the meshing gears. A key in the base serves to maintain accurate alignment of the fixture on the table of the machine. The diagram at *Q* serves to indicate the calculations required in designing the gear mechanism of the fixture.

With the number of settings or work-holders given, and the diameter of the gear *M* assumed,

it was necessary to find the diameter of the small gears L. The diameter of these gears must be such that when the turret is revolved 60 degrees or one-sixth revolution—there being six settings—the work-holder will revolve through an angle of either 90 or 270 degrees with respect to the stationary part of the fixture. Either of these angles would suit the conditions, but as a movement of 90 degrees on gear C would necessitate the use of a large pinion L and a correspondingly large turret, the angle of 270 degrees was selected.

Now according to the principles of epicyclic gear trains, if the gears L are locked to prevent them from rotating in mesh with the gear M, one complete revolution of gear M, with the gears L locked in place, will result in giving gears L one complete revolution with respect to the stationary member of the fixture. Likewise one-sixth revolution of gear M will cause each of the gears L to revolve an equal amount or 60 degrees relative to the stationary fixture.

Now if the gear M is held stationary and the gear L is rolled around through an angle of 210 degrees in the direction indicated by the arrow, it will be in the position indicated by the circle R. This angle, plus the angular movement of 60 degrees when the gears are locked in place, equals the total angular movement of the small gear relative to the fixture when the turret is indexed through an angle of 60 degrees. Now if the pitch radius of gear M is 1 3/4 inches, the pitch diameter will be 3 1/2 inches. If we let x equal the circumference of the small gear L, we have the following equation:

$$\frac{210}{360}x = \frac{60}{360} \times 3\frac{1}{2}\pi$$

or

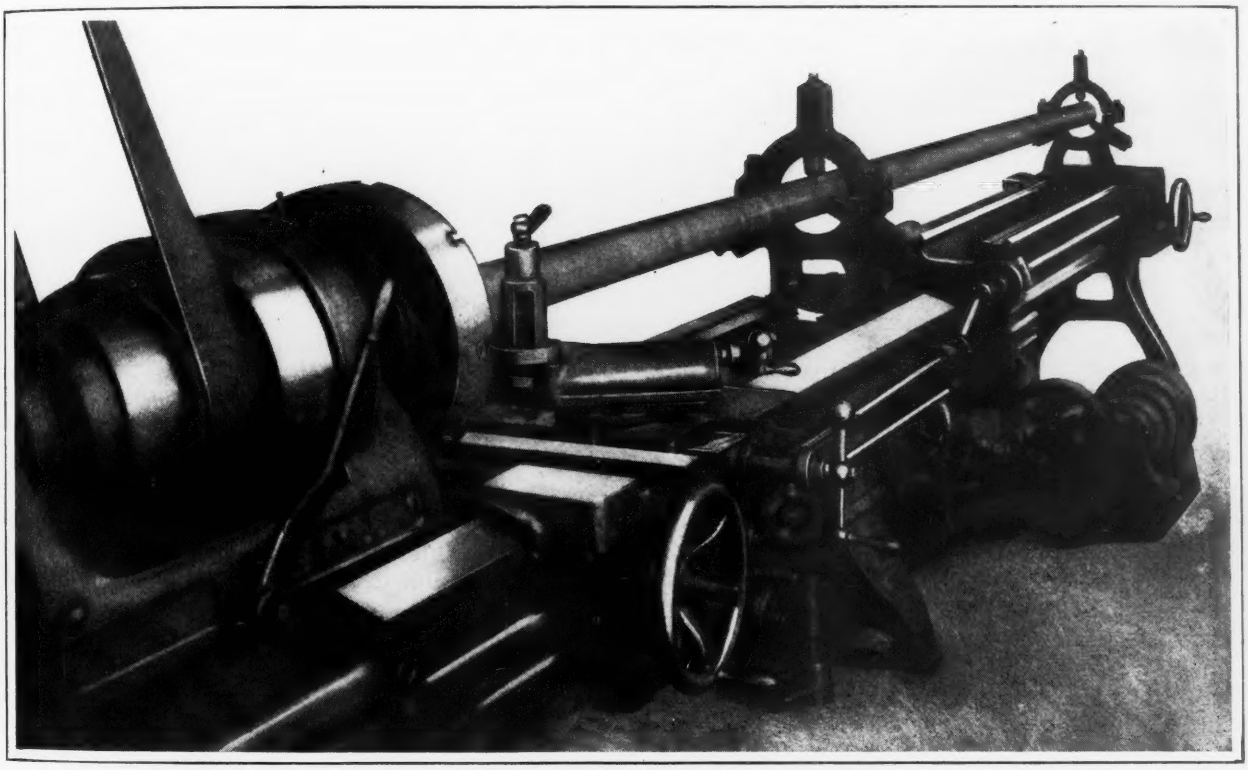
$$x = 3.1416$$

This circumference corresponds to a diameter of 1 inch, which is the pitch diameter of the gear L. Selecting a diametral pitch of 16, the gear L has 16 teeth and the gear M 56 teeth.

When the tapping fixture is in operation, the work is piled up on a pan at the left of the fixture. The operator loads and unloads the work with his left hand, meanwhile feeding the turret to the taps by a forward pressure with his right hand on the ball handle secured to the end of shaft I. The indexing movement takes place when the slide is drawn back against the lug which holds the indexing pin O by revolving the ball handle until the pin O enters the next hole in the dial N.

By referring to the plan view in the illustration, it will be obvious that one side of each of the four pieces is tapped at each feeding movement of the fixture slide, and that there are two idle positions which permit loading and unloading. It might be of interest to know that an increase of approximately 325 per cent in the production rate on this job resulted through the use of the fixture described.

* * *



Two Lathes Combined to Handle Long Work

OUT IN THE SAGE BRUSH

By PAUL F. STEINER

One way of getting by in a one-horse shop located away out in the sage brush is shown in the accompanying illustration. Two 21-inch lathes of different makes have been placed end to end in order to permit turning and threading the ends of well drill stems which vary in length from 12 to 25 feet. The illustration shows a stem 18 feet long. It will be noted that the headstock of the outboard lathe has been removed and that the two lead-screws are connected. This connection consists of two Ford universal joints and a shaft 4 feet long.

Reasons for Machine Tool Price Advances

THE purchasing department of an electrical equipment company recently sent letters to several machine tool builders asking them for the reasons that have led to the recent advances in the prices of machine tools. In the following are quoted two letters that were sent in reply. These letters are of such general interest to the entire machine-building industries that they are quoted in full. One company writes as follows:

"The increase is due wholly to the growing appreciation of the fact that the machine tool industry is liquidating itself slowly but surely by not charging enough to take care of the depreciation of its plants, and is, of course, even further removed from any possibility of growth and development.

"It is a matter of record that in the last seven years the industry as a whole (excepting only a few makers of special production machines) has made a return on its investment about half that obtainable by investment in Liberty Bonds. Under such circumstances, it is obvious that the industry will neither attract new money nor new blood, and will die of anaemia, in time.

"The machine tool industry took what was left of its war profits and put them into the designing and making of greatly advanced tools, which are not any more comparable with "pre-war" equipment than automobiles are, but the buyers have not fully appreciated this, and have encouraged the lowest possible prices; and the tool builders, being born manufacturers and not business men, have been too shy to protest.

"This has gone on for seven years, without the tool makers realizing that the whole industry was being paralyzed, instead of just individual concerns. When they begin to study profits, as an industry, the light begins to dawn a little; and when some of their good customers, in the genial happiness of their prosperity, begin to tell the world they won't buy a machine that will not pay for itself in *five months*, the machine tool builders realize that they have not only designed and built the machines upon which our present prosperity is founded, but have made endowments for life as well.

"Perhaps you will feel that all this is very theoretical, and only of interest to the makers of tools and not to their buyers, and that the only thing which can justify higher prices is an increase in pig iron or wages. The facts speak for themselves, however, and unless the buyers make it possible for their sources of supply to obtain a profit that will permit them to grow, the industry in another ten years will either be hopelessly crippled or else in the hands of a few survivors who will charge and furnish what a monopoly may dictate.

"In brief, then, the advance is due neither to the passing on of increased costs nor to a desire for luxurious profits, but is solely a matter of self-preservation."

Another machine tool builder writes the following letter:

"On January 19, 1928, we increased our prices in various amounts ranging from 4 to 12 per cent, and averaging on the whole line about 8 or 9 per cent. There were two reasons for this: During the last fifteen months we have incorporated many new features, such as power rapid traverse in all directions, Timken roller bearings, both on the gear train and the main spindle, front dial feed control, improved centralized lubrication, and a new low-pressure coolant system.

"The foregoing explains our individual problem. Our second reason, and undoubtedly the one which has influenced the recent increases for other lines, is simply this: To increase our margin of profit. The demands for new productive features, the highly technical engineering service in connection with the application of machines to the customers' problems, the cost of demonstrating and service work, plus the steadily mounting costs of distribution are all too steep to be taken care of with the relatively small volume of machines sold per year.

"The profit level in the machine tool industry is very low. In the tabulation of industries showing the return per capital invested, the machine tool industry stands almost at the bottom of the list—somewhere in the neighborhood of 3 per cent.

"In the past there have been many cases where the buyers of machine tools have borne down hard on the builder to extract the last penny of profit—playing one competitor against the other, and making unreasonable demands that the equipment must earn 50 to 100 per cent within a year's time. The weaker builders, pressed for existence, have yielded to these demands, and the whole industry has suffered. Fortunately, the situation is improving. The bigger user now appreciates the value of the machine tool builder's contribution in helping him to materially decrease his manufacturing costs. Such buyers realize that it takes money to improve machine tools; that it requires expensive designing talent; and that unless the machine tool builder can earn a reasonable return upon his investment, new models will not be forthcoming as frequently."

* * *

NATIONAL FOREIGN TRADE CONVENTION

The fifteenth National Foreign Trade Convention, which will convene at Houston, Tex., April 25 to 27, is expected to bring together executives of most of the leading manufacturing plants in the United States who are engaged in foreign trade. The program will cover many subjects of interest to exporters. Addresses will be made on the foreign trade outlook, the prospects in Europe, and foreign trade developments in the Gulf States. Among other subjects to be discussed are packing and shipping, marine insurance, trademarks and patents, the tariff, and the financing of foreign trade.

New Machinery and Tools

The Complete Monthly Record of New Metal-working Machinery

"HYDRO-MATIC" INTERNAL GRINDER

An internal grinding machine of entirely new design, which embodies several radical departures from standard internal grinder practice, is being placed on the market by the Greenfield Tap & Die Corporation, Greenfield, Mass. This machine is known as the No. 12 "Hydro-Matic." Before being introduced on the market, it was tested for over a year in actual production, and its operation was found to be thoroughly satisfactory, both as to accuracy and output. Holes from 3/4 to 3 inches in diameter and up to 4 inches deep can be ground. Taper-grinding can be accomplished by swiveling the work-head.

The most interesting innovation in the machine is a reversal of the ordinary practice in which the grinding wheel enters the work-head from the front. In the new machine, the wheel starts grinding from the rear of the work as the work is traversed past it. The work-head is reciprocated, as in other internal grinders built by the same company, by means of oil under pressure, which gives an infinite number of table speeds.

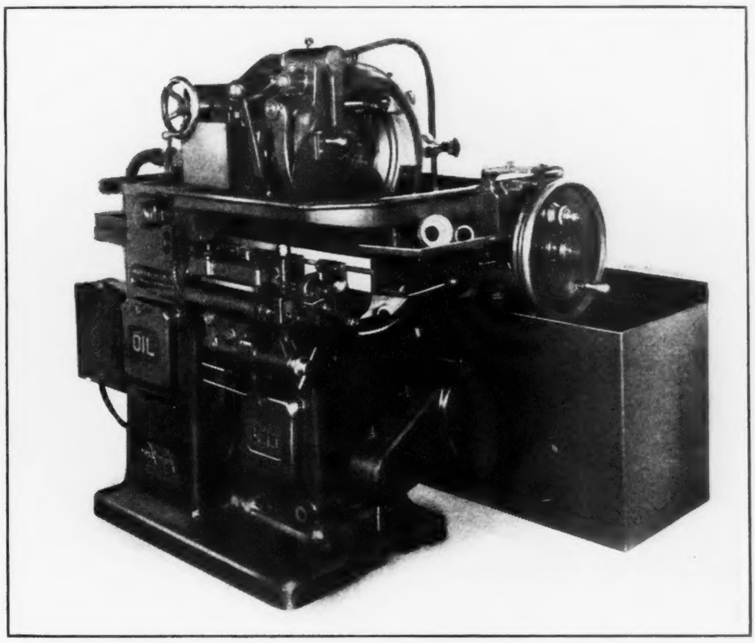


Fig. 1. "Hydro-Matic" Internal Grinding Machine with Non-traversing Wheel

Since the grinding wheel does not have a longitudinal movement and starts grinding the work from the rear, it is at no time exposed, and when the work-head is in the reloading position, the wheel is back out of the way, practically out of sight, and completely protected. This arrangement also has the advantage of making it impossible for the operator to come in contact with the wheel. The whole attention of the operator can, therefore, be devoted to loading and unloading the work-head, without having his movements restricted because of danger from a rapidly revolving wheel.

It is interesting to note that the operator's position is at the front end of the machine facing the work, instead of at the side. The levers are all placed at the front end within easy reach of the operator. The machine construction permits of flooding the work and the diamond truing device with coolant at all times for maintaining a nearly constant temperature and preventing any slight expansion or contraction of the mechanism, with consequent inaccuracy of the finished product.

Another feature of the machine is a new semi-automatic sizing device. Automatic action of the feed-screw is governed by a cam so arranged that progressively diminishing increments of wheel feed occur with successive strokes of the table. When the roughing cuts have been taken, the movement of a convenient lever passes the diamond across the wheel, after which the finishing cuts are taken with automatically known increments of feed. These feed increments, being governed by the positive action of the cam, do not vary. The diamond is fixed at all times, and thus is not subject to any minute variations which may occur when a diamond is moved into and out of the truing position.

An advantage claimed for the cam feed is that the heavier roughing cuts are taken with a clean sharp wheel. As the wheel dulls or becomes loaded, less and less strain is put on it, thus minimizing the tendency of the spindle to spring under pressure and grind work bell-mouthed. Truing of the wheel just before the finishing cut removes the dulled or loaded surface and insures an accurate mirrorlike finish.

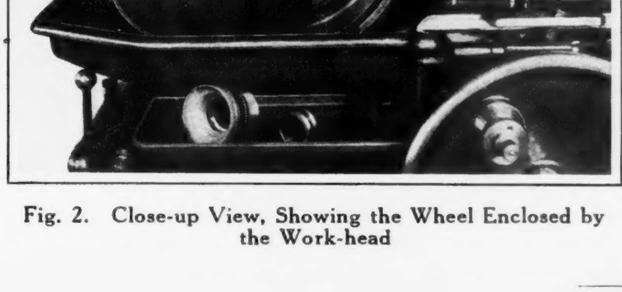


Fig. 2. Close-up View, Showing the Wheel Enclosed by the Work-head

Sometimes minute inaccuracies in the work-head bearings are magnified by the crank action of the spindle. Any difficulties from such a source have been eliminated in the No. 12 "Hydro-Matic"

by the use of a very large bearing, which is so arranged that the work is inside of the bearing or practically so. Misalignment of the bearing, if any, is thus minimized instead of magnified. It is stated that as a result of the design, the machine will grind in production within limits of from 0.0002 to 0.0003 inch.

Since this grinder is primarily a production machine, it is regularly furnished with one work-head speed. Other speeds, however, are readily available by using train gears in a box at the front end of the machine within easy reach of the operator. Ball bearings are furnished not only in the work-head, but for every revolving part, including hand-operated shafts. The operation of the machine is entirely mechanical, and there are no electrical contacts.

Compactness of the design is another feature to which attention is called. The machine is driven by one motor, and in case it is desired to drive by belt, only one belt operating direct from a main lineshaft is required. No countershaft is necessary. The machine occupies a floor space of 42 1/2 by 73 inches, and weighs about 5500 pounds.

NEWARK ATTACHMENTS FOR CUTTING BEVEL GEARS

Two attachments have been brought out by the Newark Gear Cutting Machine Co., 69 Prospect St., Newark, N. J., for rough-cutting bevel-gear teeth on the spur-gear cutting machines built by this company. Fig. 1 shows the attachment designed for application to the No. 3 machine, and Fig. 2, the attachment designed for use on Nos. 5 and 55 machines. By using the attachment on the smaller of these machines—the No. 3—miter gears up to 25 inches in diameter and 4 inches face width can be accommodated. On the Nos. 5 and 55 machines, miter gears up to 36 inches in diameter and 8 1/2 inches face width can be handled.

The construction of these attachments is essentially the same, although that shown in Fig. 1 is clamped to the work-arbor support, while that illustrated in Fig. 2 is bolted and doweled to the work-head. The latter attachment is provided with a bail to facilitate handling with an overhead hoist or crane. Both of these attachments are adjustable vertically on the machine by operating the standard work-head. The driving pinion of either attachment is mounted directly on the work-head spindle and held in place by means of a special flange collar which is tightened by the regular draw-in bolt at the back of the machine. The spindle drives the attachment pinion through a stud mounted in the end of the spindle.

From the driving pinion of the attachment, power is delivered through two other gears to the arbor on which the work is mounted. After a gear blank has been slipped on this arbor and a C-washer or nut placed over it, the work is clamped by applying a spanner wrench to a nut on the inner end of the arbor.

From the illustrations it will be obvious that the work-arbor and the gear that drives it are mounted in a housing *A* which may be swiveled relative to

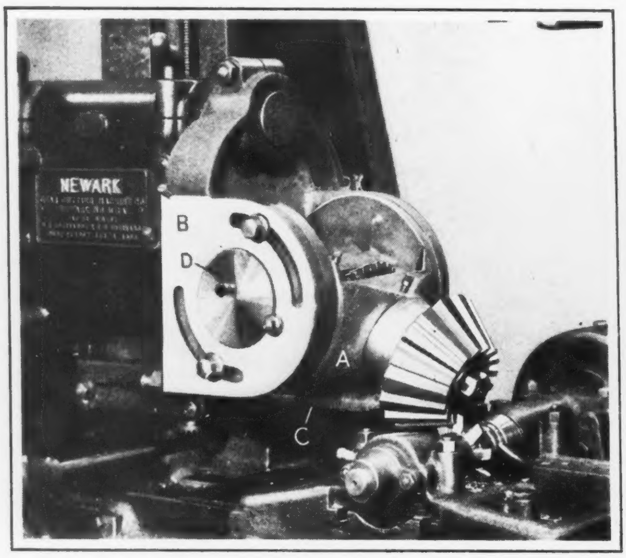


Fig. 1. Attachment which Enables Bevel Gears to be Roughed out on Newark Gear-cutting Machines

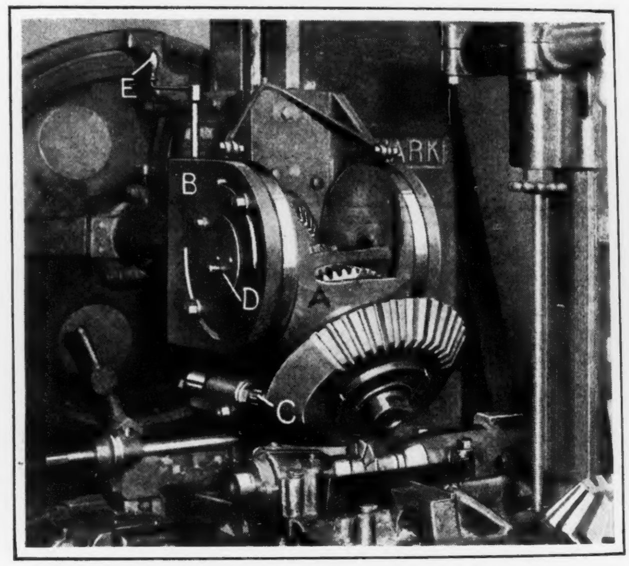


Fig. 2. Bevel-gear Cutting Attachment Designed for a Larger Machine than that Shown in Fig. 1

the housing *B*, the latter being clamped or bolted to the standard work-head. The swivel housing can be accurately adjusted to any desired cutting angle by referring to the position of graduations on the swivel housing relative to an index line on the stationary housing. After making a setting, two cap-screws are tightened on each side of the attachment to lock the swivel housing in position for the operation.

Adjustments of this housing, in the case of the attachment shown in Fig. 2, are accomplished by merely revolving a crank *E* to actuate worm-gearing. The swivel housing of the attachment shown in Fig. 1 is adjusted by hand.

The standard cutting-depth dial of the machine is employed when machining bevel gears in the same manner as when cutting spur gears. Cuts are taken to the same depth as for spur gears of the same pitch. The rim-rest stud *C* is also set snugly against the work. With smaller gears, the rim-rest stud can be set against the attachment itself. The object of this stud is to place the cutting strains on the column. Any objectionable backlash developed in the attachment gear train, through long

service, can be eliminated by adjusting the large trunnion D on which the intermediate gear is mounted, so as to move this gear toward the two mating pinions.

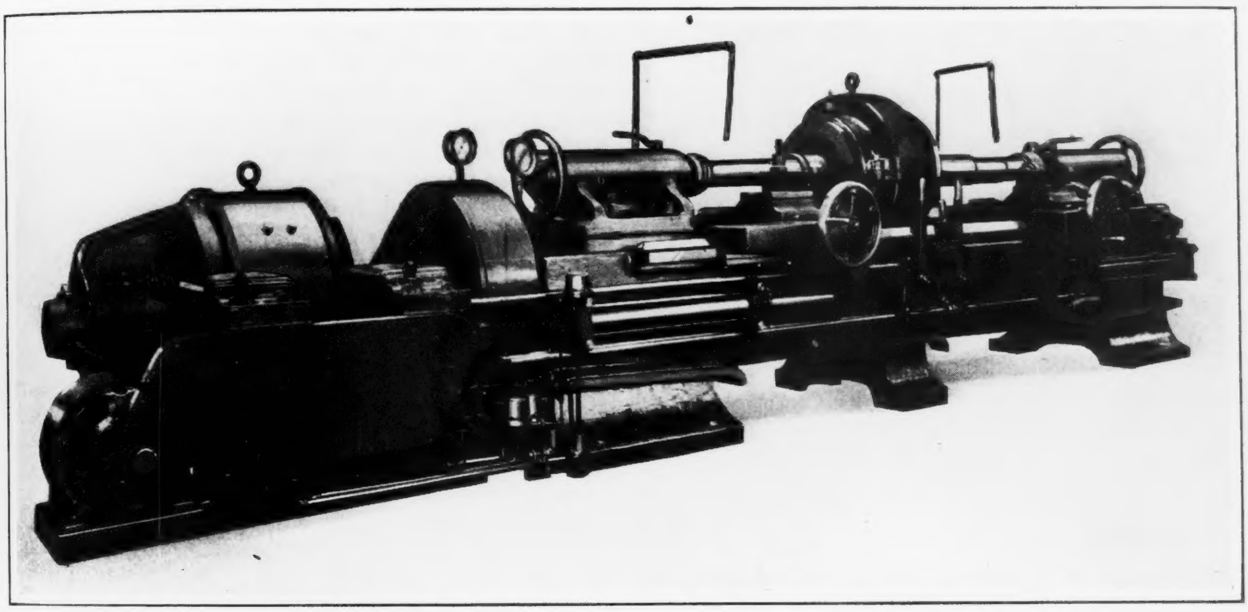
These attachments have the strength of the regular machine and do not weaken it. Owing to the fact that the bevel roughing cutters are slightly narrower than spur gear cutters, bevel gears are actually roughed out faster than spur gears of the same pitch.

CONSOLIDATED CENTER-DRIVE AXLE LATHE WITH OILGEAR FEED

A heavy-duty center-driven axle lathe equipped with an Oilgear feed for the carriages, has recently been brought out by the Consolidated Machine Tool Corporation of America, Rochester, N. Y. The application of the Oilgear feed represents an advance over previous designs. Feed gearing is done away with, and the carriages are operated entirely by power, thus speeding up production and reducing manual effort on the part of the operator.

A positive feeding pressure is applied to each tool by oil cylinders attached to the under side of each carriage at the front and back. This application directly under the tools permits unusually heavy cuts and feeds. Adjustable automatic stops are provided for both carriages. Control levers for setting the rate of feed and for traversing the carriages by power are located at the center of the machine, where they are within reach of the operator. The power traverse is at the rate of 6 feet per minute, while any feed from 0 to 1/2 inch per revolution is instantly available.

The main drive is either through an adjustable-speed motor and a single train of gears, or through a constant-speed motor and a three-speed gear-box. Sykes herringbone gears are provided in the center driving head. The two Oilgear pumps are driven by one 3-horsepower constant-speed motor. The machine illustrated is equipped with a 35-horsepower adjustable-speed driving motor for specially heavy-duty service, ordinary requirements calling for a 25-horsepower motor.



Consolidated Center-drive Axle Lathe with Oilgear Feed to the Carriages

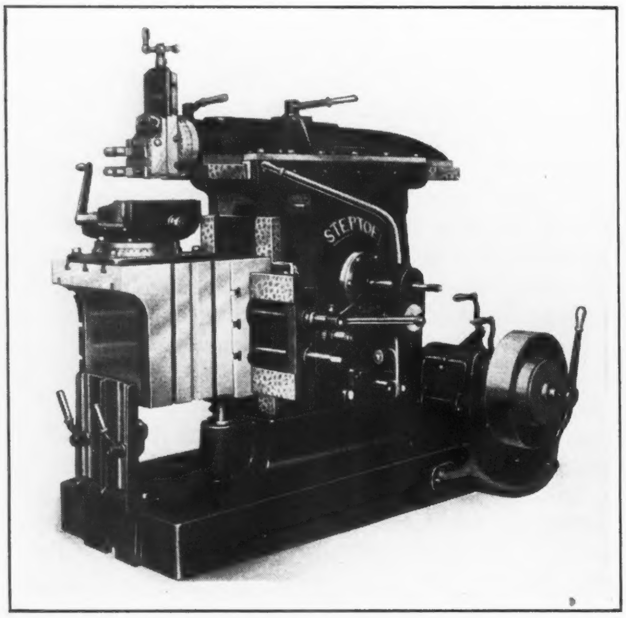
STEPTOE IMPROVED SHAPERS

An improved line of Steptoe shapers has recently been developed by the Western Machine Tool Works, Holland, Mich., which are equipped throughout with Timken tapered roller bearings. This line includes 14-, 16-, 20- and 24-inch machines. The housings for the Timken bearings are bored out of solid metal, and the bearing cups are pressed into the housings, thus insuring the maintenance of correct center distances between gears. In case the bearings do wear slightly, the center distance between gears can be restored by means of adjusting nuts.

Another feature of these shapers is that the length of stroke can be adjusted while the machine is at rest or in motion. The device for changing the stroke is self-locking, thus preventing any chance for the stroke to vary during an operation. The ram can be quickly adjusted to suit the position of the work, and a short stroke can be taken at any point.

The shapers have a centralized control, all levers for starting and stopping a machine, controlling the speed, making feed changes, and adjusting the ram or its stroke being easily reached from the working position of the operator. Another feature is a simplified lubrication system. The bearings are all pressure grease-lubricated, and since they are enclosed in grease-proof and dust-tight housings, the lubricant need only be renewed about every three months. The speed-box gears run in an oil bath.

The amount of feed can be varied to meet requirements. The cross-rail screw is threaded for its full inside length, thus giving the greatest possible amount of table travel along the cross-rail. There is also a power vertical feed for the table. The back-gears consist of a pair of sliding gears. When one gear is working, the other is out of mesh so that wear occurs only on the gears when they are actually running. Through these back-gears two speed changes are available for each change obtained through the speed-box or the cone pulley. The speed-box is of the selected type and provides



Steptoe Shaper Equipped Throughout with Timken Tapered Roller Bearings

four changes of speed which, in combination with the back-gears, gives a total of eight cutting speeds to the ram. Speed changes may be made while the machine is running.

The head is graduated 60 degrees in each direction. It can be instantly set and held at any angle by means of a lever at the back of the head. The bull gear is balanced to give a smooth drive to the rocker arm. Either a direct-connected motor drive, a single-pulley drive, or a cone-pulley drive through a countershaft, can be furnished.

Index-centers designed especially for shaper work, but which can be used on milling machines, planers, or drilling machines, may also be furnished. These index-centers take work up to 10 inches in diameter and up to 13 inches long between centers. The weight of single-pulley driven machines and motor-driven machines, without the motor, ranges from 1975 to 4100 pounds. Machines with a cone-pulley drive range in weight from 1625 to 4050 pounds.

GISHOLT STATIC BALANCING MACHINES

MACHINERY for April, 1927, contained an illustrated description of an 18-inch static balancing machine built by the Gisholt Machine Co., Madison, Wis. Three new sizes of static balancers are now being placed on the market by the same company for work up to 12, 24, and 36 inches in diameter, respectively. In general construction, the new sizes follow the 18-inch machine, although certain mechanical features have been added. For instance, a lead-screw is provided to permit ready adjustments of the drill spindle for drilling the balancing corrections to different radii when a variety of parts is being handled. The machines are also built with either a belt-driven or a direct motor-driven drill spindle. Drill spindles of 1/2- or 1-inch drilling capacity can be furnished.

The 12-inch machine is designed for light high-speed work, such as clutch parts, small fans, small flywheels containing magneto magnets, etc. This machine is very sensitive, as in balancing such parts it is important that very small amounts of unbalance be detected. The 24- and 36-inch machines handle large flywheels, heavy grinding wheels, large fans, and other large-diameter narrow-faced parts.

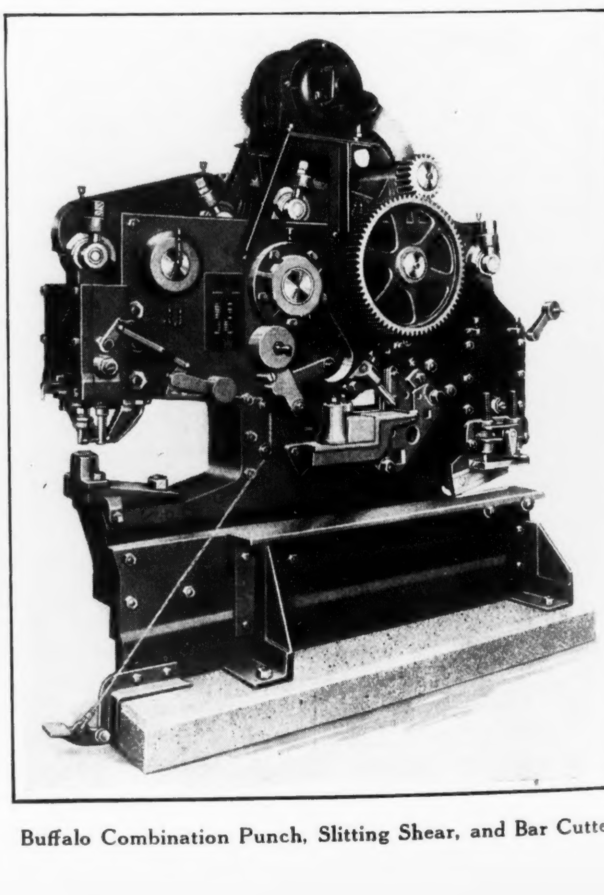
BUFFALO COMBINATION PUNCHES, SLITTING SHEARS AND BAR CUTTERS

Two larger machines have been added to the line of "Universal Iron Workers," or combination punches, slitting shears, and bar cutters, built by the Buffalo Forge Co., 144 Mortimer St., Buffalo, N. Y. These new Nos. 2 1/2 and 3 1/2 machines have been developed for shops that require equipment of large capacities and yet do not need the high punch throat of the Buffalo 25 to 29 UD punches, slitting shears, and bar cutters. The lower throat gives a compact and strong design.

One eccentric operates all three tools on each machine, that is, the punch, shear, and bar cutter. The three tools are actuated successively during the course of one revolution of the eccentric, and not at the same instant. This prevents overloading of the machine and permits using the three separately controlled units at the same time.

Interchangeable high and low die-blocks on the punch end permit the handling of I-beams, channel irons, girders, Bethlehem beams, and H-sections. The stripper swings out of the way for changing tools. The shear blades are unusually long and reversible. The bar cutter is the same as on other UD machines. Angle-irons can be cut to a miter without inclining the stock. A triple punching attachment can be supplied.

The No. 2 1/2 machine will punch holes 1 3/16 inches in diameter through 3/4-inch plate or 1 inch in diameter through 7/8-inch plate; it will shear



Buffalo Combination Punch, Slitting Shear, and Bar Cutter

3/4-inch plates through the center or trim 7/8-inch plates. This machine will also cut round stock up to 2 1/4 inches in diameter or 2-inch square stock. The No. 3 1/2 machine will punch 1 1/4-inch holes through 7/8-inch plate or 1 1/16-inch holes through 1 1/16-inch plate; it will shear 7/8-inch plates through the center or trim 1-inch plates. This size machine will cut round stock up to 2 1/2 inches in diameter or 2 1/8-inch square stock. On each machine, the depth of throat is 20 inches. The No. 2 1/2 machine is driven by a 10-horsepower motor, and the No. 3 1/2 machine by a 15-horsepower motor.

HANNA PNEUMATIC RIVETERS

Two single-purpose pneumatically operated cold-riveting machines have recently been built by the Hanna Engineering Works, 1763 Elston Ave., Chicago, Ill., as shown in the accompanying illustrations. The machine shown in Fig. 1 was developed for riveting spokes to the rim of tractor wheels, while that illustrated in Fig. 2 is intended for use in manufacturing automobile chassis frames. With each stroke, the tractor wheel riveter cold-heads two 3/8-inch rivets that secure each spoke to the rim. The rivets are inserted from above and headed from below, an air-actuated elevating device nesting the manufactured head of the rivets in the upper die. Tractor wheels from 32 to 56 inches in diameter can be accommodated on this riveting machine.

The rivet driving unit consists of the Hanna pneumatic toggle-and-lever mechanism. The toggles close the gap between the riveting dies with

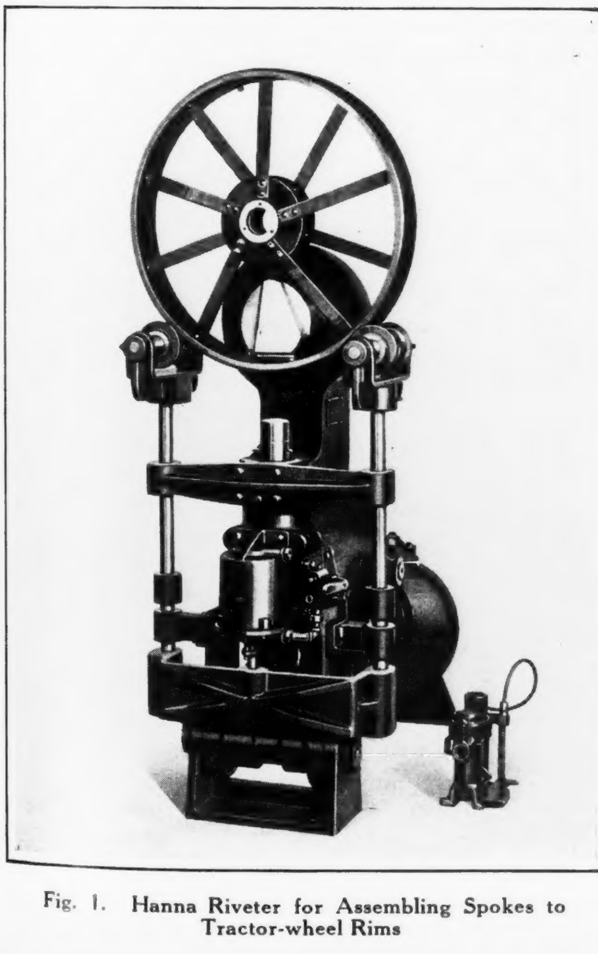


Fig. 1. Hanna Riveter for Assembling Spokes to Tractor-wheel Rims

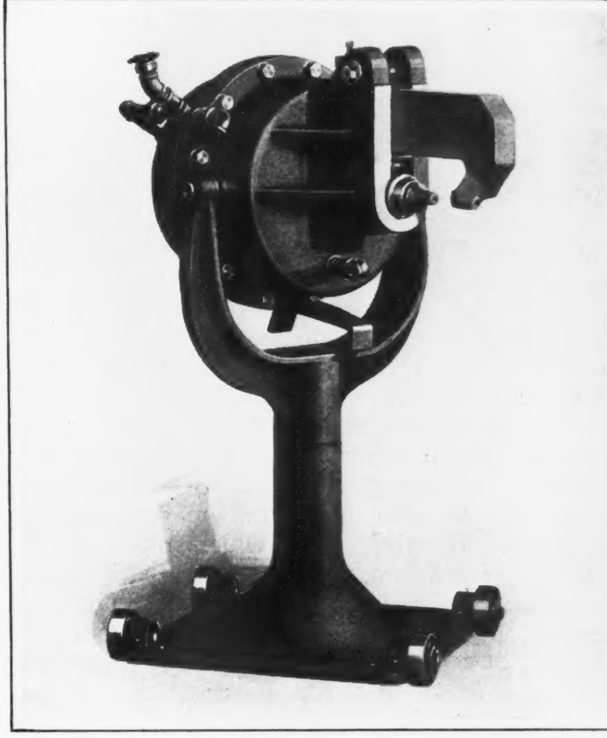


Fig. 2. Push-type Riveter for Use in Manufacturing Automobile Chassis Frames

little air consumption, while the lever exerts uniform pressure on the dies through a considerable portion of the die stroke, regardless of variations in the thickness of the work. The machine has a reach of 4 inches and a gap of 10 inches.

The push-type chassis-frame riveter shown in Fig. 2 drives the horizontal rivets which secure the chassis frame cross-members to the web of the side bar, as well as the rivets which fasten the step hanger brackets to the chassis frame. The inner or stationary nose of the riveter is C-shaped to hook over the flange of the side bar. The riveting operation is facilitated by a provision for tilting the rivet driving mechanism above the horizontal axis of the dies.

Arranged as shown, the rivet driving mechanism may also be rotated around a vertical axis which, with the cross-travel provided, permits of riveting on both sides of a chassis frame as it passes along the riveting line. This riveter has a 3-inch reach, a 7-inch gap, and a 2 1/2-inch die stroke. It is available in 15- and 20-ton capacities for driving 5/16- and 3/8-inch rivets cold.

SMALLEY-GENERAL THREAD MILLER

A No. 20 thread milling machine recently introduced to the trade by the Smalley-General Co., Bay City, Mich., constitutes an improvement on the No. 23 machine formerly built by this concern. While primarily a production machine, it can be quickly changed from one job to another, and can thus be economically operated on small quantities of work. It will mill outside or inside, right- or left-hand threads, and when equipped with a taper attachment, will mill threads tapered up to 4 inches per foot. External threads from 1/8 to 8 inches in diameter can be milled, and internal threads from 1/2 to 12 inches in diameter. The number of

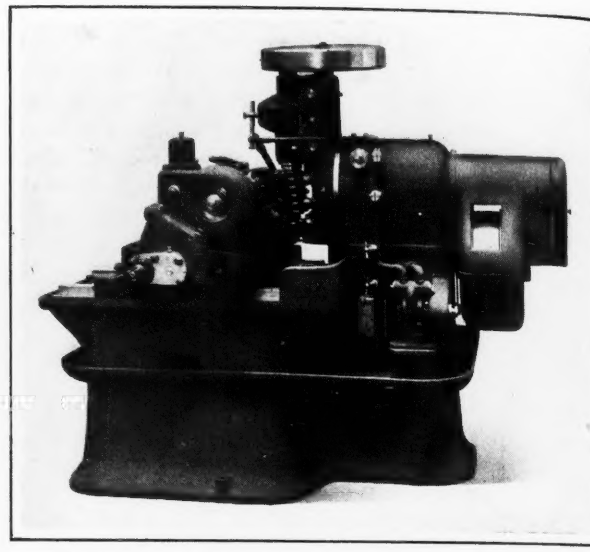
threads may range from thirty per inch upward. The machine can also be used for form milling operations.

An outstanding improvement is the roller-bearing milling head, the milling spindle and the pinion shaft which drives it being mounted in Timken tapered roller bearings. The milling spindle is driven by helical gears which run in oil. The arrangement of the milling head is such that a tool can be attached for turning surfaces adjacent to the thread, true with it. It is stated that the rigid construction of the milling head eliminates chatter and the necessity of using a sizing die or tap on work after milling.

The main spindle has a 6 5/8-inch hole through the center, and is flanged at the front end to permit chucks to be quickly changed. Several types of chucks may be used, depending on the work and the quantity of pieces. The chuck illustrated is a 5-inch three-jaw chuck, and is operated by means of a hollow air cylinder which permits long work, 5 inches in diameter, to be extended through the spindle.

Either a motor or a belt drive can be provided. The motor-driven machine gives eight speeds to the main spindle and six to the milling spindle, when a four-speed motor is employed. The belt-driven machine has a three-step cone pulley on the main spindle and a pulley on the pinion shaft of the milling head. Separate countershafts are furnished for each spindle, and each has two friction pulleys, so as to give two forward or reverse speeds to the countershaft.

Although the machine is primarily of the chucking type, it can be furnished with a tailstock and live center. An attachment can be furnished for relieving taps and dies. Taps can be milled and relieved at the same time after fluting. There is a patented feed mechanism which distributes wear over the entire length of the thread on the lead-screw. It is not necessary to wait for a split nut to pick up the thread, since the feed-lever can be thrown in at any time. With this device, a thread can be started at any point on the circumference of the work. For instance, double and triple threads have been milled with a single ring tooth cutter with all threads proper as regards lead and pitch. A reversible pump delivers coolant either to the inside or the outside of the work.



"Pfauter" Gear-hobber for Spur Gears, Splined Shafts, Worms, etc.

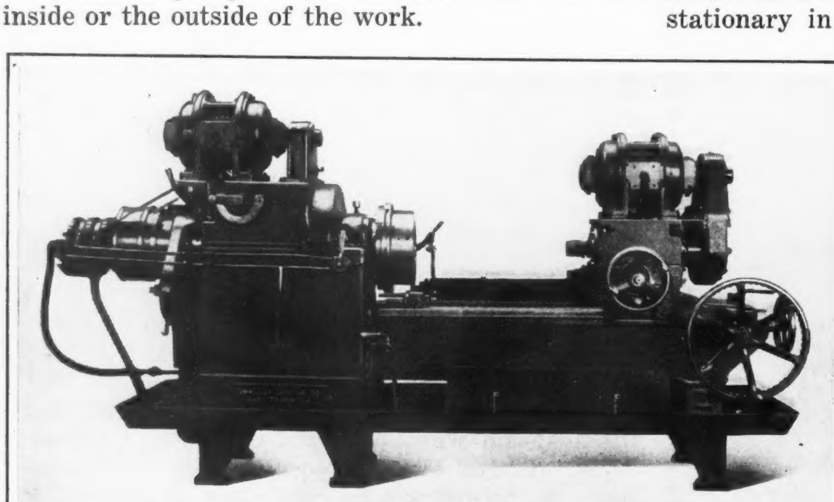
"PFAUTER" GEAR-HOBBER

Spur gears, heavy splined shafts, worms for automobile rear-axle drives, etc., may be machined on a No. 9 "Pfauter" gear-hobber recently placed on the market by O. Zernickow, 21 Park Row, New York City. The machine is intended for heavy-duty production work at high speed. It has a single-pulley drive, and can be arranged to be driven by a 7-horsepower direct-connected motor. Six hob speeds, ranging from 44 to 127 revolutions per minute, are obtainable through change-gears. These change-gears have a large tapered bore so that they can be rapidly put on or taken off. The cutter-head can be swiveled 100 degrees in either direction, settings being accomplished by means of worm-gearing inside the head.

The hob is driven through spur gears, there being a heavy flywheel on the driving pinion to impart a steady motion to the hob. The hob spindle is adjustable lengthwise and sidewise. The indexing mechanism consists of a worm-gear and a hardened steel worm ground all over. The worm is adjustable in both directions and runs in an oil bath.

Work is held either between centers or in split collets. The radial hob pressure is taken up by means of a steadyrest. The cutter-head remains stationary in an operation and the work travels past it. Any desired feed is obtained through change-gears. The feed may be stopped automatically or by hand. There is a coolant tank in the bed of the machine.

Some of the principal specifications of this gear hobber are as follows: Swing, 10 5/8 inches; maximum distance between centers, 21 5/8 inches; minimum center distance between the hob and work-arbor, 1 1/4 inches; maximum diameter of hob, 5 3/4 inches; maximum length of hob, 5 1/2 inches; amount that hob can be shifted, 1 5/8 inches; floor space required, 69 by 86 inches; and weight, about 5500 pounds.

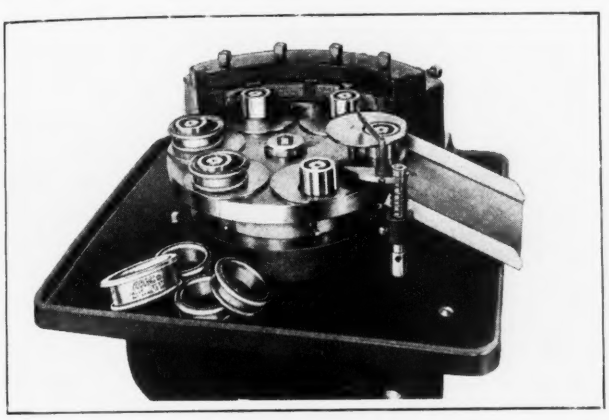


Smalley-General Thread-milling Machine of Improved Construction

NOBLE & WESTBROOK MARKING MACHINE

A marking machine equipped with an extra large holder having four dies has recently been built by the Noble & Westbrook Mfg. Co., 20 Westbrook St., East Hartford, Conn. The work consists of rings, such as shown in the illustration, the dies marking these rings in four different locations. In general construction, the machine is the same as the No. 24 "Rapid Production" machine built by this company.

The parts to be marked are placed on stations or pins on the dial, which revolves continuously to carry the parts to the dies. After being marked, the parts are unloaded automatically, so that the work of the operator consists solely of placing the parts on the stations. The dial is driven by worm-gearing, which runs in a bath of oil. This style of machine is designed to mark tubular parts made



Noble & Westbrook Marking Machine with Dial Feed

of thin materials without distorting them. A production of 100 pieces per minute can be obtained, depending upon the size of the work and the speed of the operator. The machine is motor-driven.

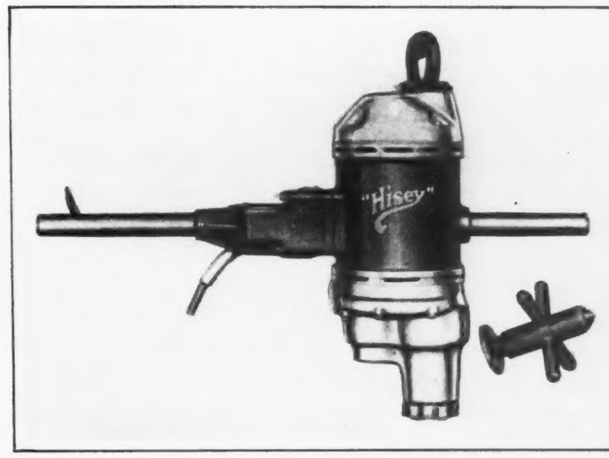
CHAIN FOR FORD "TRIBLOC" HOISTS

"Tribloc" hoists, which are built in capacities of from 1/4 to 20 tons by the Ford Chain Block Co., Second and Diamond Sts., Philadelphia, Pa., are now provided with a high-carbon steel, electrically welded chain. Every link is tested with special instruments, and when the chain is assembled, it is again tested and must show an overload capacity of 50 per cent above its rated capacity. The chain is said to offer unusual resistance to wear and not to stretch to any extent under heavy loads.

HISEY 1 1/4-INCH UNIVERSAL DRILL

A universal drill having a capacity of 1 1/4 inches has been added to the line of portable electric tools built by the Hisey-Wolf Machine Co., Cincinnati, Ohio. This drill is equipped with a standard Hisey motor that is mounted in ball bearings fitted in a way to eliminate slip and creeping action. The gear on the armature shaft is removable.

The drill spindle is fitted with a No. 3 Morse taper socket, and is automatically lubricated through the gear-case. The brush-holders



Hisey 1 1/4-inch Universal Portable Electric Drill

are mounted as a separate unit on a bakelite yoke, the construction permitting brush adjustments when necessary. The end handle cover is independent of the motor and motor bearings and thus relieves them of strains, as well as affording access to the carbon brushes for renewal. The Hisey patented automatic self-release switch is furnished.

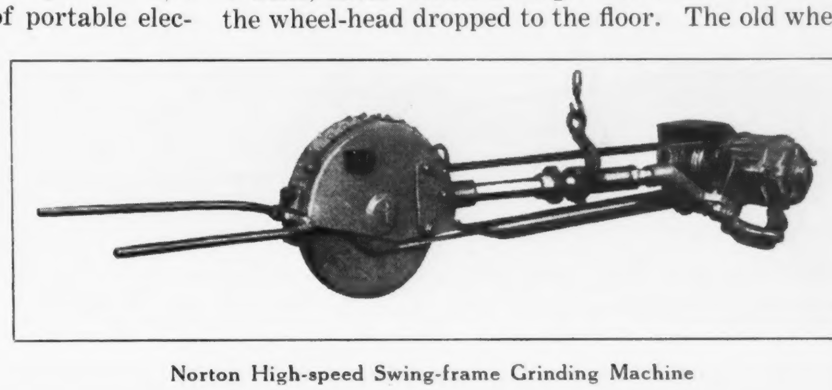
NORTON SWING-FRAME GRINDING MACHINE

A 24-inch swing-frame grinding machine intended for use with bakelite-bonded grinding wheels in high-speed snagging operations has been placed on the market by the Norton Co., Worcester, Mass. This machine is balanced both laterally and rotatively, which together with its comparatively light weight of 850 pounds, makes it easy to handle.

The fabricated steel hood provides protection for the operator and complies with Safety Code requirements. Wheels 24 inches in diameter, from 2 to 3 inches thick, and with either 8- or 12-inch holes, can be accommodated. Two speed changes are possible through the medium of a duplex sheave on the motor, so that either 20- or 24-inch wheels can be operated at 9000 surface feet per minute.

The wheel is driven by two flexible V-belts, one on either side. These belts are practically slip-proof and permit of making the wheel flanges and sheaves integral, thus obtaining a narrow wheel-head assembly. The design allows the operator a clear vision of the work from either side of the machine. Heavy-duty barrel-type ball bearings are provided. The complete bearing assembly, which is dustproof, is placed within the hole of the wheel.

Wheel changes are easily made. A toggle arrangement on the motor is operated to release the V-belts, after which a single bolt is removed and the wheel-head dropped to the floor. The old wheel



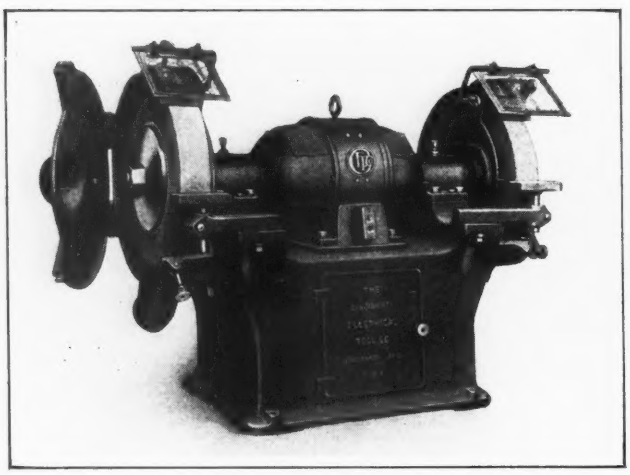
Norton High-speed Swing-frame Grinding Machine

can then be removed by taking off the combination sheave and flange.

The machine may be suspended in two ways, at the center as shown, or fastened rigidly with a cable to the ceiling at the rear, with the wheel-head supported by a counterweighted rope running over pulleys. A completely enclosed ball-bearing 10-horsepower motor is used for alternating-current installations. The control is through push-buttons on the wheel guard.

CINCINNATI HEAVY-DUTY FLOOR GRINDERS

Floor grinders designed for heavy operations in foundries, steel mills, railroad and forge shops, etc., have been brought out by the Cincinnati Electrical Tool Co., a subsidiary of the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. These grinders are made in three sizes of 5-, 7 1/2- and 10-horsepower capacity, respectively. The motor of each machine is fully enclosed, and the spindle is mounted in four Timken tapered roller bearings



Cincinnati Heavy-duty Floor Grinder

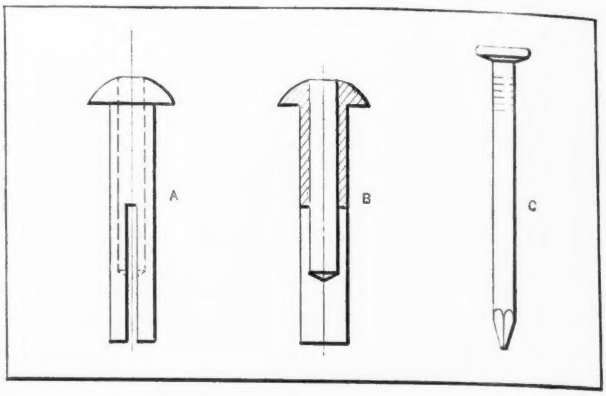
which run in oil. Provision has been made for excluding grit and dust from the bearings. The bearings can be adjusted for wear by a nut.

The wheel guards are made of cast steel and are equipped with exhaust connections. They have a 4-inch adjustment to suit the wear of wheels. Hinged covers enclose the sides of the wheels, the flanges and the nuts, to afford protection to the operator. Non-breakable adjustable eye shields, as well as chip breakers, are furnished. The grinding rests are adjustable, and can be removed in cases where they interfere with the movements of the operator. The abrasive wheels have a 12-inch bore which effects a saving in the initial cost and reduces discarded wheel losses to a minimum.

The starter is of the safety fully enclosed type, with both overload and under-voltage protection. It is mounted in the base. There is a push-button control station on the motor frame. These grinders are built for two- or three-phase alternating current of 220, 440, or 550 volts, and for direct current of 115 or 230 volts.

BRUSH NAIL EXPANSION BOLTS

Expansion bolts which can be quickly anchored in brick, concrete, steel, or other hard materials, and readily withdrawn, are being placed on the



Brush Expansion Bolt and Expanding Nail

market by the Brush Nail Expansion Bolt Co., Greenwich, Conn. The bolt proper consists of a rustproof metal part, such as shown at *A* and *B*. It is drilled for a considerable portion of its length to accommodate nail *C*, and is slotted at the lower end. After the bolt has been inserted into a hole, the inner slotted end is expanded firmly against the wall of the hole by driving nail *C* into the bolt. The sole purpose of the nail is to serve as a wedge on the slotted portion of the bolt.

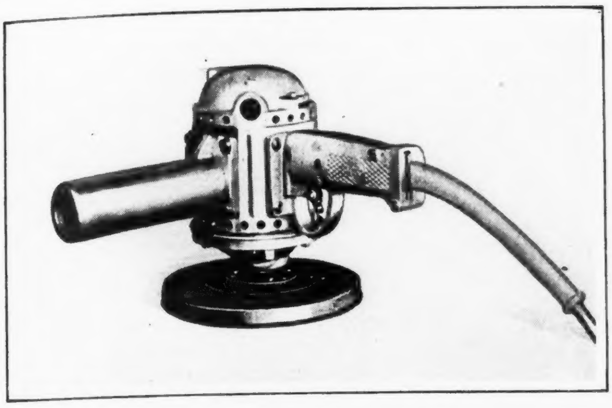
This expansion bolt is made in all sizes and with various types of heads. Sizes from 3/16 by 5/8 inch to 3/8 by 3 inches are carried in stock. The smaller sizes are intended for installing electrical conduit boxes, etc., while the larger sizes are suitable for fastening machines to floors.

LYON ALL-METAL TRUCK

An all-metal truck for general shop use has recently been brought out by the Lyon Iron Works, Greene, N. Y. Loading and unloading of tote boxes, etc., is easily accomplished, because the truck is low in height, easily tilted, equipped with a special nose that can be slid under boxes, and provided with two rolls 1 5/8 inches in diameter, which extend the width of the platform.

There are three casters, two of which are 4 inches in diameter and the other, 3 inches. All three casters are provided with roller bearings. "Divine" cushion wheels, "Nokut" wood wheels, etc., can be furnished when desired, semi-steel wheels being supplied as regular equipment. The platform is 5 inches above the floor, and measures 22 by 32 1/2 inches. The truck was designed for loads up to 500 pounds and weighs about 100 pounds.

Lyon All-metal Truck for General Shop Use



Black & Decker Electric Sander

BLACK & DECKER ELECTRIC SANDER

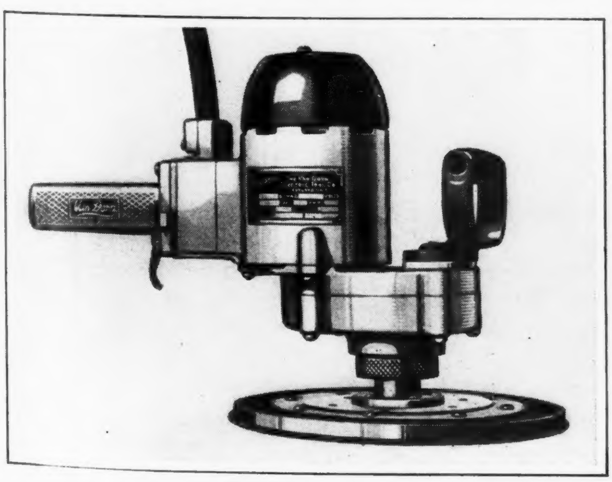
An electric sander has been added to the line of products manufactured by the Black & Decker Mfg. Co., Towson, Md. This equipment has a sand pad, which is driven by a motor through a train of heat-treated steel gears running in a grease-tight compartment. The motor and all revolving shafts are equipped with ball bearings. A pistol grip and trigger switch are provided on the sander, and it is made for all voltages.

VAN DORN "FLEX-DISC" GRINDER

The portable electric flexible-disk grinder or sander here illustrated is being introduced to the trade by the Van Dorn Electrical Tool Co., Cleveland, Ohio. This device is intended for finishing metal and wood surfaces by grinding and sanding, respectively. The motor and general construction are the same as in Van Dorn electrical drills. The motor has a no-load speed of 2400 revolutions per minute, and can be operated on either alternating or direct current.

A 9-inch flexible rubber pad serves as a base for a 9 1/4-inch abrasive disk. This "Flex-Disc" feature makes possible the grinding or sanding of curved surfaces. A 6-inch flexible rubber pad is also made for use with the equipment. This pad affords an economy, in that when the 9 1/4-inch abrasive disks become worn, they may be cut down for use with the 6-inch flexible pad.

A Duco or lacquer polishing pad of heavy felt, covered with a removable cloth bonnet, is interchangeable with the flexible rubber pad for converting the grinder into a polishing machine. Five removable cloth bonnets, which may be laundered as they become soiled, are supplied with each polishing pad. This grinder can be furnished for use on 110-, 220- or 250-volt current.



Van Dorn Sander and Grinder with Flexible Rubber Pad

WESTINGHOUSE MOTOR STARTER

A motor starter with a maximum rating of 7 1/2 horsepower has been brought out by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., to complete a line of full-voltage starting devices ranging from 1 to 75 horsepower in capacity. This "Linestarter" is particularly suited for the starting and protection of small induction motors driving machine tools, textile machinery, and other machines where a remote control with complete protection to the operator, motor, and machine is desired. It can also be used as a magnetic primary switch for wound-rotor motors.

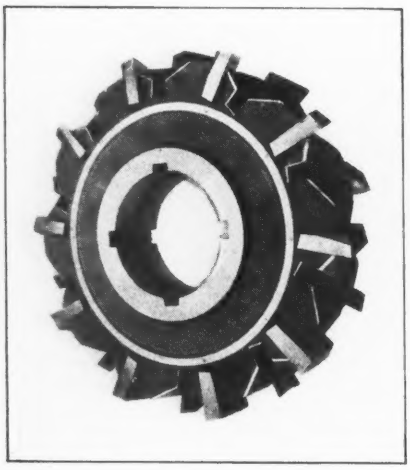
Westinghouse Starter for Squirrel-cage Induction Motors

A feature of this starter lies in its adaptability to either hand or automatic resetting after an overload. It comes equipped with a hand reset of the thermal overload relay, but an automatic arrangement can be furnished. The dimensions of the starter cabinet are 8 1/2 inches wide, 12 1/2 inches high, and 5 3/4 inches deep.

O. K. TOOL CO.'S MILLING CUTTERS

A heavier type of cutters for slotting and facing operations has been added to the line of inserted-blade milling cutters manufactured by the O. K. Tool Co., Inc., Shelton, Conn. These cutters are made up of drop-forged tapered and serrated high-speed steel blades, 3/4 inch thick, which are inserted in a chrome-nickel steel forged and heat-treated body. Cutters as large as 36 inches in diameter and 4 inches in width, with a single body, have been made. In the past, the blades have been made in a variety of shapes, but only in thicknesses of 1/4, 3/8 and 1/2 inch.

The tapered surface serves to lock each blade securely in the body without the aid of screws, taper pins, or a split body construction, while the serrations permit adjustments for wear. The new



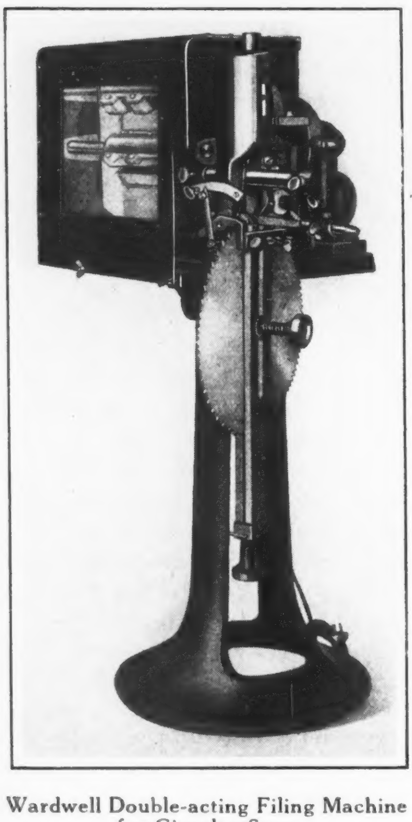
Milling Cutter Made by the O. K. Tool Co.

cutters are made in any of the standard designs, such as slotting cutters; side-mills, both straight and angular; half side-mills; face mills, etc. Suitable rake and spiral angles, as well as adequate chip clearance, are provided. The cutter illustrated is 18 inches in diameter, 3 inches wide, and has a 6-inch hole. The tool blades may also be used on boring and facing heads, hollow mills, trepanning tools, etc.

WARDWELL DOUBLE-ACTING CIRCULAR SAW FILER

Circular saws of cross-cut or rip types can be sharpened in one operation on a "Super" model F double-acting machine recently brought out by the Wardwell Mfg. Co., 111 Hamilton Ave., Cleveland, Ohio. Saws from 4 to 18 inches in diameter, with teeth measuring up to 1/2 inch from point to point, can be accommodated. The speed of filing is seventy teeth per minute. The sharpening of band saws on this machine can also be arranged for when desired. Either a pedestal type machine, such as illustrated, or a bench type may be furnished. The drive may be by motor or by belt.

The saw being sharpened is automatically swiveled and each tooth successively filed in the direction in which it is set. Cross-cut teeth are automatically beveled, jointed, and the points balanced. Any amount of bevel up to 40 degrees can be obtained by making a simple adjustment. The set of teeth is kept true on both sides and any amount of hook can be given to the teeth. A cross-cut saw is centered under the file by means of a gage which moves the back vise-jaw in or out.



Wardwell Double-acting Filing Machine for Circular Saws

After being started, the machine is fully automatic. Standard double-end three-cornered taper files are employed. For the motor-driven machines, a 1/4-horsepower motor, running at 1750 revolutions per minute, is used. The main drive shaft runs in Timken tapered roller bearings, while the thrust of the motor worm-shaft is taken by a ball bearing. All filing chips and dirt fall below the machine.

BAKER HYDRAULIC-FEED MULTIPLE-SPINDLE CYLINDER-BORING MACHINE

A semi-automatic hydraulic-feed cylinder-boring machine which may be built with two, four, six, or eight spindles, spaced at fixed center distances to meet the individual requirements of the automotive

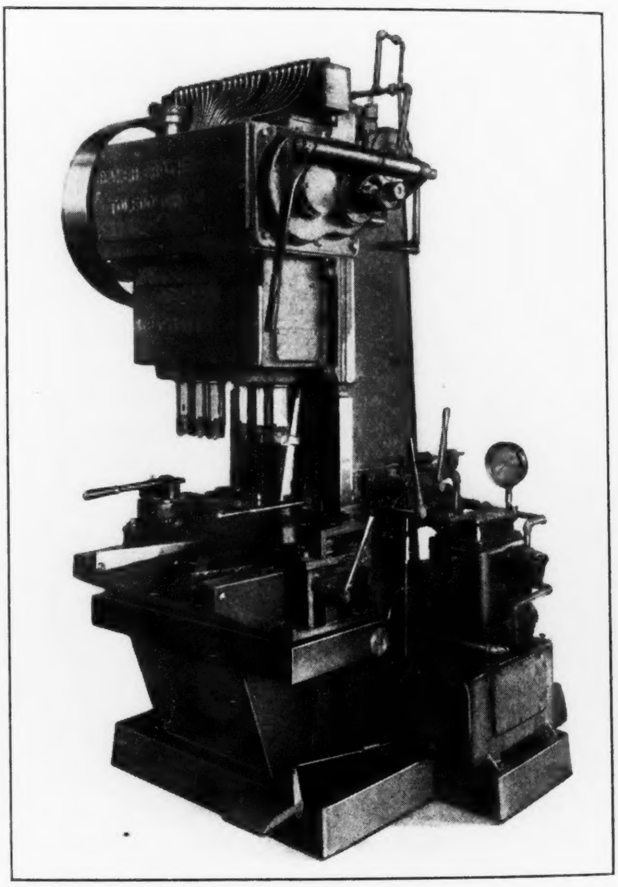


Fig. 1. Baker Multiple-spindle Cylinder-boring Machine

field, has recently been brought out by Baker Bros., Inc., Toledo, Ohio. The spindles are of maximum diameter as governed by the center distances between the bores in the cylinder blocks. One of the features of this machine is the provision of two long adjustable tapered bearings at the lower end of each spindle, as close as possible to the point where the cut starts. Because of this construction, both rough- and finish-boring cuts are taken in a number of plants without any added support for the boring-bars. Each bearing is readily accessible for adjustment. Spindle speeds are provided according to the size of the cylinder bores. A manual means of starting and stopping the spindles is furnished through a convenient lever.

The table moves vertically to carry the cylinder to and from the cutters, the movements being obtained through an Oilgear hydraulic system. From

Fig. 2 it will be seen that there is a hydraulic cylinder mounted on a pivot at the top of the main frame. This cylinder is mounted at an angle, and in addition to moving the table vertically, it also produces a thrust for holding the table rigidly against the ways of the machine. This insures accuracy and positive alignment at all times. The table is arranged with taper take-up gibs and has a long bearing on its ways.

There is a rapid advance of the table to the point of cutting, an automatic engagement of the feed, and an automatic rapid return to the starting position. At the end of the cycle, the machine stops automatically. The position at which the change from the rapid traverse to the working feed takes place can be easily altered, as it is determined by

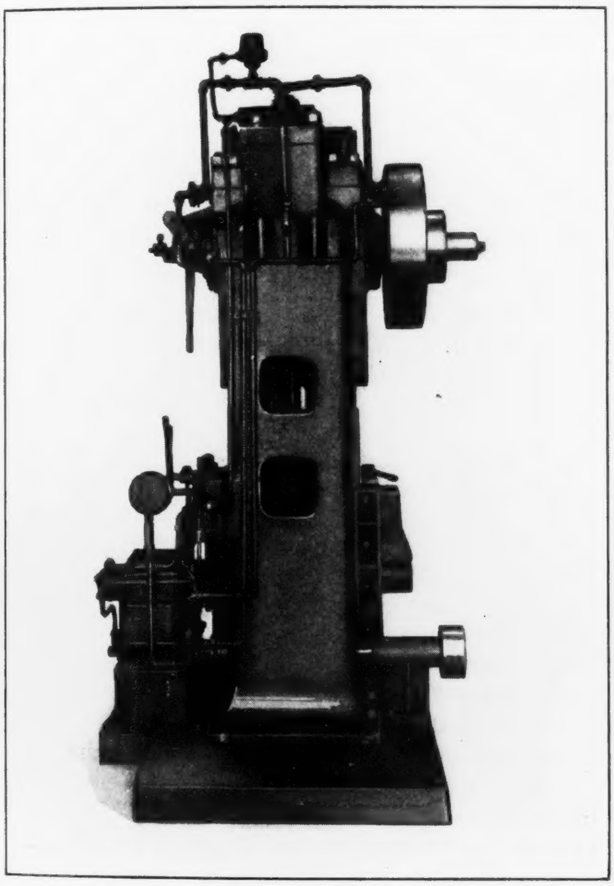


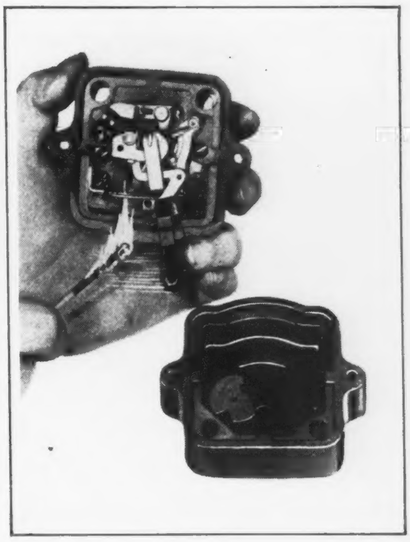
Fig. 2. View Showing Arrangement of the Oilgear Hydraulic Equipment

flat cams which can be set in any position. The rate of feed is variable within the range of the Oilgear pump, and the changes are easily made. This pump is driven by a two-horsepower motor which is supplied as standard equipment. The rapid traverse and the quick return are constant.

The machine can be furnished with either a belt or a motor drive. The spindles are driven through hardened alloy steel gears mounted on shafts equipped with ball bearings. An automatic lubricator is furnished on top of the machine (see Fig. 1) for delivering oil to all gears and bearings.

CIRCUIT-BREAKER FOR GRINDERS

An automatic circuit-breaker recently designed by the United States Electrical Tool Co., 2477 W. Sixth St., Cincinnati, Ohio, is being applied to the 7-inch electrical grinder built by that company. When a lever in this new type of starting switch is thrown into the "on" position, a small dog holds the current on until the device is overloaded or tripped by hand. This device is carefully calibrated, and will trip only within the limits specified by the underwriters.



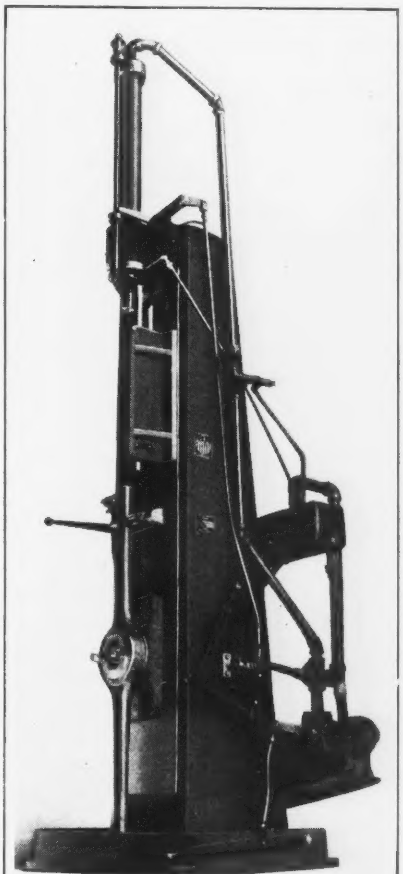
Automatic Circuit-breaker Made by the United States Electrical Tool Co.

The switch is of simple construction, there being no springs or complicated mechanism to get out of order. The casing is made of molded bakelite, while the lever is also made of bakelite, protecting the operator against shocks. The holding screws are concealed so as to prevent tampering without detection.

AMERICAN AXLE-HOUSING BROACHING MACHINE

A special hydraulically operated machine for broaching out of automobile rear-axle housings the flash produced in welding operations has recently been built by the American Broach & Machine Co., Ann Arbor, Mich. As shown in the illustration, the axle housing is held vertically for the operation, being mounted on a large stud and centered at the upper end by means of a centering device. About one minute is consumed in broaching both ends of the housings.

The broach is held in a rotating head, although the illustration does not show the broach in place. It cuts out the flash on



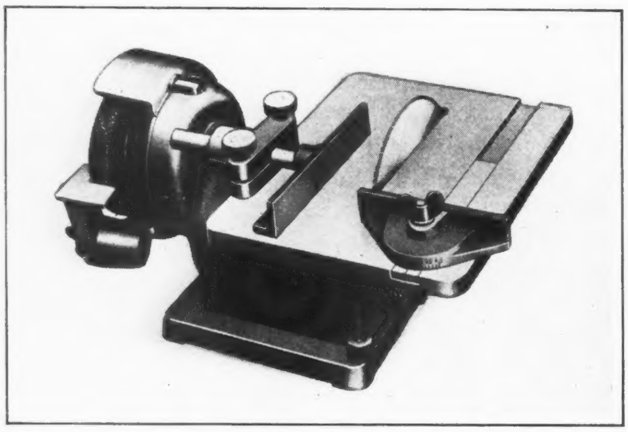
American Broaching Machine for Axle Housings

the downward stroke. Upon the completion of the cut, the head is revolved by means of a cam device, so that when the broach is withdrawn from the housing on the return stroke, it will not drag on the finished surface. The cam device is mounted on the angle casting which is bolted to the machine frame.

This machine is equipped with a direct motor drive having a 10-horsepower motor. Automatic stops are provided for regulating the length of stroke. There is a foot-pedal as well as a hand-lever control. The machine occupies a floor space 6 feet square, and has an over-all operating height of 17 feet. The capacity is 12 tons, and the maximum stroke, 24 inches.

BLACK & DECKER SPECIAL SAW TABLE

A saw table designed to extend the scope and usefulness of the electric combination grinder made by the Black & Decker Mfg. Co., Towson, Md., has been brought out by this concern. The saw table can be quickly mounted on the grinder, as shown in the illustration, and raised or lowered to meet requirements. Work can be sawed accurately to any angle up to 45 degrees. Wood up to 1 3/4 inches thick can be sawed, and the device will also



Black & Decker Combination Grinder Equipped with Saw Table

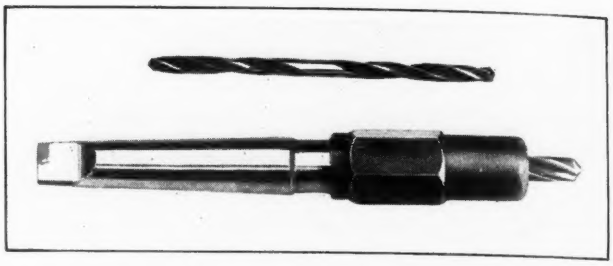
saw aluminum, brass, copper, bakelite, fiber, etc. The saw table is furnished in combination with the grinder or separately.

"STICK-TO" CHUCKS AND DOUBLE TWIST DRILLS

A chuck designed to eliminate the breakage of drills and to permit the use of broken drills is being placed on the market by the Specialty Trading Corporation, 551 Fifth Ave., New York City. This chuck grips the twist portion of a drill without marring or dulling the cutting edge and will also grip the round shank.

The chuck consists of two principal parts, a hollow arbor and an outer sleeve. When these are screwed together, they hold a drill firmly with internal tapered surfaces and another sleeve that is slit and beveled at both ends. The twist drill is held in two places, there being eight contact points to prevent slippage and maintain alignment.

The projection of the twist drill from the chuck



"Stick-To" Double Twist Drill and Chuck

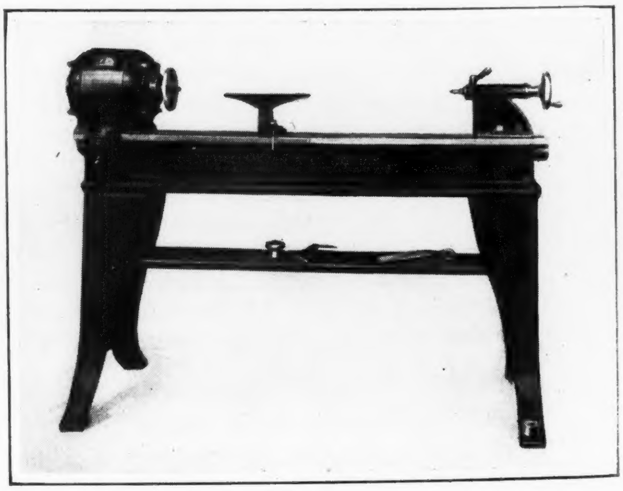
may be regulated according to the depth of the hole or the desired free length. The chuck may be used with quick-change collets and in multiple-spindle work, etc., both for drilling and tapping. Each chuck takes five sizes of drills, varying by sixty-fourths of an inch.

One of the double twist drills is also shown in the illustration, the double twist giving, in effect, two drills in one. When one end becomes dull, time can be saved by inverting the drill in the chuck and using the other end. Practically the full length of a drill can be used, because there is no shank to be discarded. These drills are made in a complete range of sizes from 1/32 to 1/2 inch in diameter.

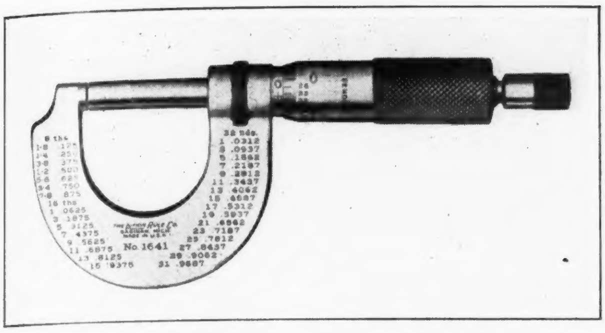
"UNION" MOTOR-IN-HEAD SPEED LATHE

A "Union" wood-working speed lathe with a motor-in-head drive is being placed on the market in three sizes by the Gallmeyer & Livingston Co., 344 Straight Ave., S.W., Grand Rapids, Mich. These sizes are built with beds 4 feet 2 inches, 5 feet 4 inches, and 6 feet 4 inches long, and swing work 26, 40, and 52 inches long, respectively, between centers. The height from the floor to the top of the bed is 36 inches, and from the top of the bed to the centers, 6 inches. Work up to 1 foot in diameter can be swung over the bed, and up to 9 1/2 inches in diameter over the tool-rest.

The machine can be equipped with alternating- or direct-current 1/2-horsepower ball-bearing motors. A spindle speed of 1725 or 3450 revolutions per minute may be provided. In cases where one machine is desired for both large and small work, two interchangeable motors can be supplied, so that a slow-speed motor can be quickly replaced by a high-speed motor and vice versa. The tool-rest is adjustable vertically, and can be swung to any desired angle.



Union Motor-in-head Speed Lathe for Wood-turning



Micrometer Numbered for Every Thousandth-inch Graduation on the Sleeve

LUFKIN MICROMETERS WITH RAPID-READING FEATURE

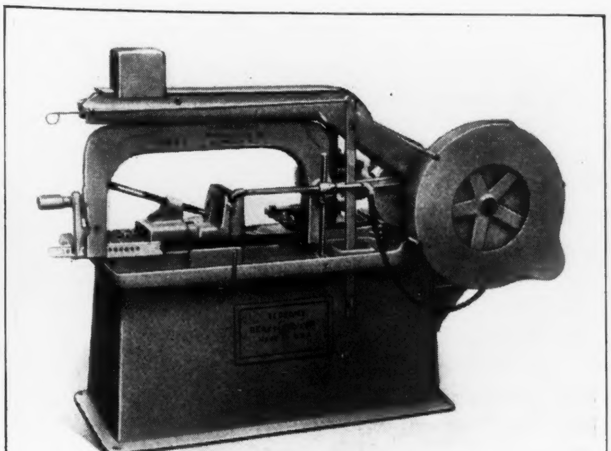
All micrometers manufactured by the Lufkin Rule Co., Saginaw, Mich., are now graduated in a manner that facilitates the rapid reading of settings. Each thousandth-inch graduation on the sleeve is numbered consecutively up to twenty-five. Every number representing five-thousandths inch is shown more prominently than the numbers in between. Previously, only every five-thousandths-inch graduation was numbered.

The new system is intended to simplify readings and eliminate mistakes. In making a reading, it is only necessary to add the figure seen at the reading line on the sleeve to the last twenty-five thousandths-inch line seen on the micrometer hub.

ROBERTSON METAL-CUTTING SAW

The "Economy" No. 4X power hacksaw machine recently developed by the W. Robertson Machine & Foundry Co., Inc., 56-58 Rano St., Buffalo, N. Y., is shown in the accompanying illustration. This machine has a rated capacity of 9 by 9 inches, and an actual capacity of 9 5/8 by 9 5/8 inches. It is driven by a single pulley on the drive shaft through gearing to an expanding clutch on the crankshaft without the use of a countershaft. Motor-driven types are driven direct from a fiber pinion on the motor shaft to a gear on the machine. A 3/4-horsepower motor is employed.

Double gears give frame speeds of 72 or 100 strokes per minute suitable for sawing hard and soft metals. Changes in speed are made by pushing or pulling a button lever at the end of the drive



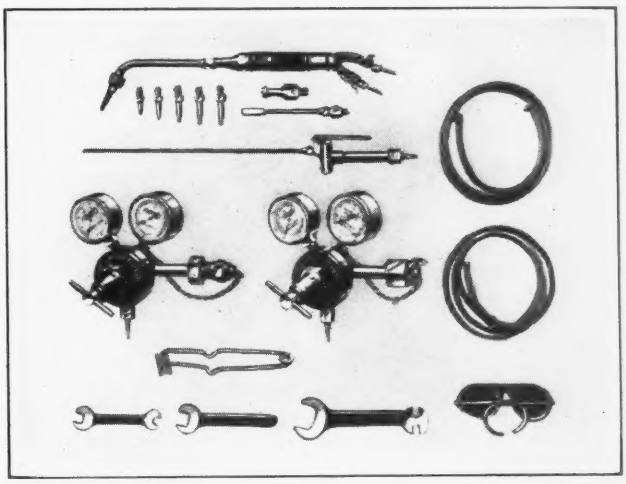
Robertson Metal-cutting Saw

shaft. The clutch, which nests inside the large gear, is actuated through a lever that extends to the operating position, when starting a cut. It disengages automatically at the end of a cut.

The machine is equipped with the Robertson oil-compression lift feature, by means of which the frame is lifted on the return stroke to relieve the blade teeth of back drag. The vise is quickly adjustable from 0 to 9 inches, and may be swiveled up to 45 degrees for cutting stock at angles. Cooling liquid is held in a receptacle formed by the base, and is pumped to any part of the blade through a piston pump and adjustable piping. The feed is obtained by gravity with the aid of a large weight that is adjustable along the top of the main-slide bearing. The weight of a belt-driven machine is 700 pounds, and of a motor-driven machine, complete with motor and starter, 825 pounds.

"PREST-O-WELD" WELDING OUTFITS

Three "Prest-O-Weld" welding outfits known as the type W-101-A automobile repair outfit, type W-102-A general-purpose outfit, and type W-102-B



"Prest-O-Weld" General-purpose Welding Outfit

welding outfit have been placed on the market by the Oxweld Acetylene Co., 30 E. Forty-second St., New York City. These outfits were made possible by the addition to the "Prest-O-Weld" line of two small two-gage regulators—types R-106 and R-107—and two special blowpipe tips, one for heating and brazing operations and the other for radiator soldering operations.

The general-purpose outfit is shown in the illustration. It is intended for any repair shop that wishes to employ the oxy-acetylene process for welding, decarbonizing, heating, soldering, brazing, lead burning, etc. Five welding tips and a decarbonizing blowpipe, as well as heating and radiator soldering tips, are included. By the addition of a cutting attachment, any of the three outfits may be used for cutting wrought iron or steel.

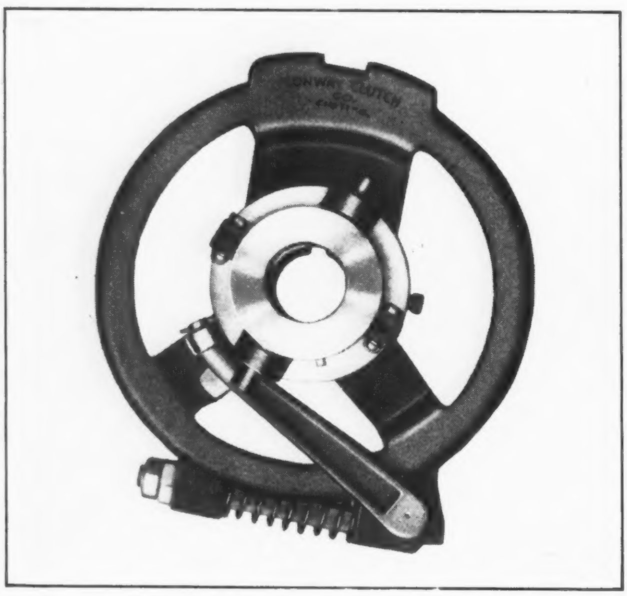
CONWAY COMPRESSION CLUTCH

A compression clutch intended for use on shafts making not more than 300 revolutions per minute, where a contracting-band type of clutch offers the best means of starting and stopping, is a recent development of the Conway Clutch Co., 1962 W.

6th St., Cincinnati, Ohio. Simplicity of design and compact construction, both as regards the swing diameter and the lengthwise shaft space required for a given horsepower, are among the features to which particular attention is called. The clutch is made in four sizes, having capacities for transmitting up to 75 horsepower at 100 revolutions per minute. The diameters of the friction surfaces range from 12 to 20 inches.

This clutch is operated by the familiar form of shifter yoke, which slides a cone member under a roller on the end of the operating lever. When the cone slides under this lever, contracting the friction band, the high leverage ratio insures the application of ample driving power. When the operating lever is thrown in the reverse direction to release the clutch, a spring assists in throwing the friction band out of engagement.

When the shifter cone is pushed under the operating roller, the lever slides on a finished surface

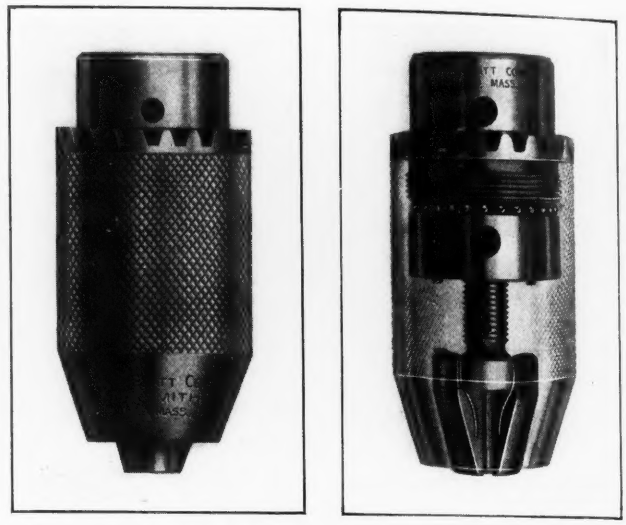


Conway Contracting-band Clutch

of the clutch carrier, this surface taking the end thrust and allowing the lever to move freely up or down. The friction lining may be replaced with ease. To do this, it is not necessary to remove the clutch from the shaft, but simply to remove two screws and push the pulley, sprocket, gear, or drum along the shaft a distance slightly more than the width of the friction band. The friction band can then be slipped over the lineshaft, a new lining substituted, and the band replaced.

GOODELL-PRATT GEAR-OPERATED DRILL CHUCKS

Self-tightening gear-operated drill chucks are being introduced to the trade in three sizes by the Goodell-Pratt Co., Greenfield, Mass. One of these sizes takes drills from 0 up to 1/4 inch; the second, up to 3/8 inch; and the third, up to 1/2 inch. The smallest size weighs eight ounces; the intermediate size, sixteen ounces; and the largest size, twenty-four ounces. These chucks have been developed especially for production drilling, but they are also intended for tool-room and machine shop use, as well as for application to portable electric drills.



Goodell-Pratt Self-tightening Gear-operated Drill Chuck

They are made of steel throughout, the jaws and the gear ring being hardened.

Although each chuck is fitted for key operation, the key is not necessary except under unusual circumstances, as a high gripping action is developed by hand alone. The greater the torsional strain placed on the drill and jaws, the tighter the jaws will grip. A patent has been applied for to cover this feature. A ball bearing makes closing and opening of the chuck smooth and easy. The key furnished with each chuck has hardened teeth, and the cross-handle can be applied as a spanner wrench for holding floating spindles while the chuck is closed or opened by hand. The chuck shanks are provided with taper holes.

ROSS GRINDING-WHEEL DRESSER

A dresser designed particularly for truing 36-inch, 42-inch, and other large-diameter grinding wheels operated at high peripheral speeds, has been placed on the market by the Ross Mfg. Co., 2196 Clarkwood Road, Cleveland, Ohio. This "Big Boss" model is equipped with thirteen cutting disks, 3 5/16 inches in diameter. The large disks, it is pointed out by the maker, maintain a correct ratio with the circumference of the wheel and reduce the number of revolutions of the disks in truing, thus giving them a longer life and greater cutting speed.

Ross Grinding-wheel Dresser

The disks are mounted on a flatted sleeve which turns on 1 1/2-inch bearings. They are heat-treated and of an open pattern that does not fill up with wheel particles. The pattern is also said to re-

move the loaded surface of wheels without dulling fresh crystals. The slotted holder-head is a feature which permits quick replacement of disks.

Dust washers of a new design seal the bearings against grit. A double-adjustment device prevents the bearing assembly from developing end play and looseness. It is mentioned that the device is capable of removing 1/64 inch of loaded surface on a wheel at a single pass.

LITTELL CLINCH-NUT FEEDS FOR PUNCH PRESSES

Five new types of feeds have recently been applied to punch presses by the F. J. Littell Machine Co., 4125 Ravenswood Ave., Chicago, Ill., for fastening clinch nuts to automobile bodies. These feeds

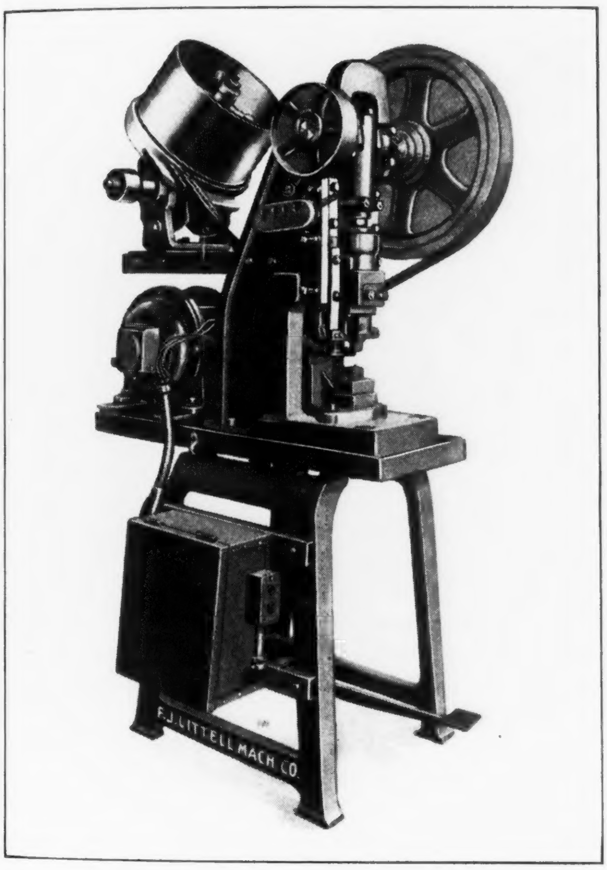


Fig. 1. Littell Punch Press with Feed for Automobile-body Clinch Nuts

not only speed up production but also enable clinch nuts to be fastened in out of the way places on body parts. Clinch nuts may be fed to either the top or bottom of work, and the feeds are designed to take flat-sided as well as round nuts.

The model B feed, which is illustrated in Fig. 1, is made in two styles, for long and short strokes, respectively. This feed is particularly useful in fastening round nuts to body parts that are deeply grooved or curved in a way that makes access to the nuts difficult, if not impossible. The round nuts fed by this model are fastened into hexagonal holes and curled over the hexagonal sides of the holes, as shown in the lower part of Fig. 2. The operator may feed the body part at any angle he chooses.

The model A feed is somewhat similar to the model B, but it feeds the nuts from the bottom and also lifts the body piece out by means of an auto-

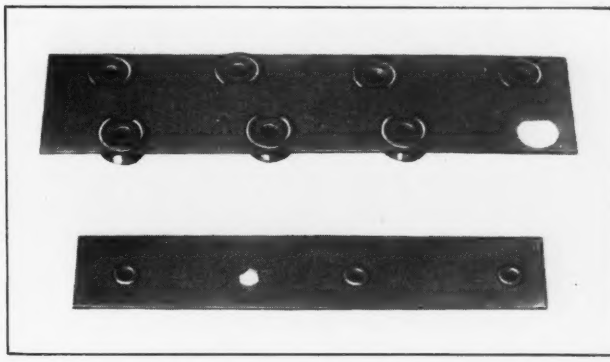


Fig. 2. Work Performed with Feed Shown in Fig. 1 and Similar Models

matic device. The lifter has a disappearing action, so that another piece may be fed to the button immediately after the removal of the previous piece. This model is also intended for feeding round clinch nuts.

There is a model C feed which is a variation of the model A, but instead of raising the piece straight up, the automatic lifter on this feed ejects it to the front. This style of feed is arranged with a thin anvil so that nuts may be inserted inside of U-shaped parts. A fifth model is especially designed for feeding D-shaped or flat-sided nuts, such as seen in the upper part of Fig. 2. Nuts can be fed to either the top or the bottom of the work. While all these feeds are especially suitable for automobile body work, they may be used for other purposes that present similar problems. A good operator can set and fasten from twenty-five to thirty-five nuts per minute with these feeds.

STOW FLEXIBLE SHAFT EQUIPMENT

A direct-connected suspended unit is the latest addition to the line of flexible shaft equipment made by the Stow Mfg. Co., Inc., Binghamton, N. Y. This unit is shown in Fig. 1. The motor is of one-horsepower capacity and of ball-bearing design. It

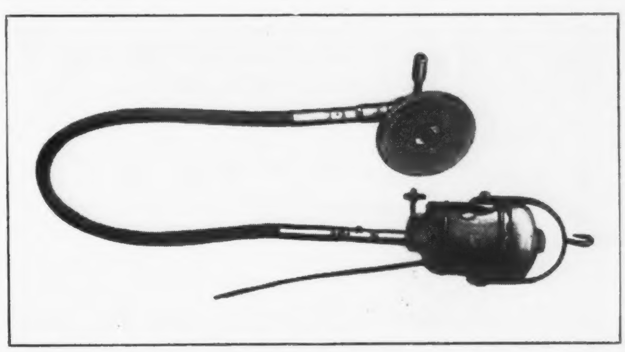


Fig. 1. Stow Direct-connected Suspended Flexible Shaft

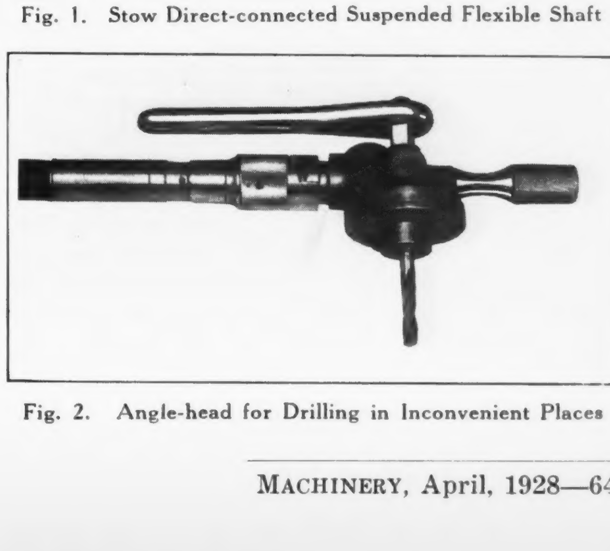


Fig. 2. Angle-head for Drilling in Inconvenient Places

delivers power through a flexible shaft which is also of ball-bearing construction. The standard shaft length is 6 feet, but any length may be provided. An angle-head can be furnished as illustrated, or a rotary drive may be obtained direct from the end of the flexible shaft without using an angle-head, for driving rotary files, sanding disks, abrasive wheels, buffing and polishing pads, and various other attachments.

An angle-head recently developed by this company enables drilling operations to be performed in out of the way places. This head is illustrated in Fig. 2. It derives its power through a flexible shaft which may be driven by a portable electric drill, an available motor, etc. It may also be belt-driven from a lineshaft. The angle-head is commonly furnished in a 1/2-inch capacity, but it may be obtained in other sizes. There is a 1 1/4-inch screw-feed with a ratchet handle. The socket takes Morse taper-shank drills, and where space permits, a chuck may be applied. This head is especially useful in applying shock absorbers to automobiles, installing automobile fenders, drilling large castings too heavy to move, and drilling both metal and wood when an ordinary portable electric drill or a hand bit cannot be used because of lack of space.

KRUPP INDICATOR AND GAGES

An indicating device known as the "Mikrotast," which can be provided with various attachments to suit the gaging of many kinds of work, has been developed by Fried. Krupp, A.G., Essen, Germany. This device, separately, as well as gages equipped with it, is now being introduced on the American market by the Coats Machine Tool Co., Inc., 108-112 W. Fortieth St., New York City. Gages are manufactured for measuring external and internal cylindrical surfaces, external and internal tapered surfaces, threads, teeth of spur, worm, and spiral gears, etc. There is a device for checking the width of bearings on crankshafts, and there are various types of depth and height gages, as well as fixtures and other appliances of special design.

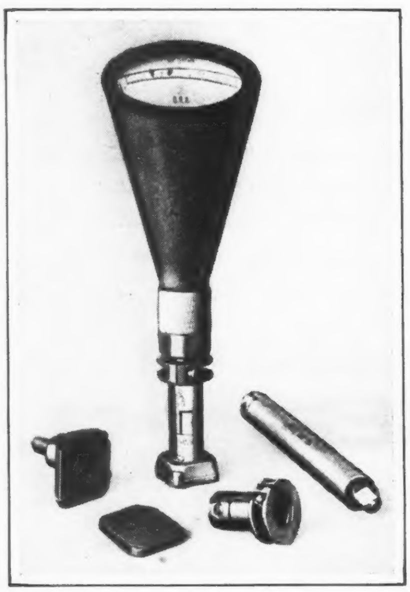


Fig. 1. "Microtast" Arranged as a Fixed Internal Gage

The "Mikrotast" works on the knife-edge principle, and can be calibrated to give readings as fine as 0.00004 inch. Its wearing surfaces are made from an alloy stated to be harder and having greater wearing resistance than hardened steel. Fig. 1 shows this indicating device arranged as an internal fixed gage. Internal measuring plates, and adapter, and an extension rod are also shown. In Fig. 2 the device is shown mounted on a saddle for checking large cylindrical surfaces.

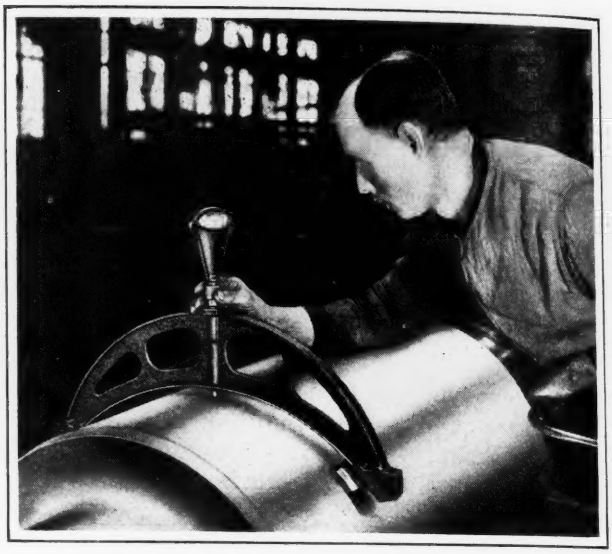


Fig. 2. "Microtast" Saddle Gage for Checking Large Rolls

GENERAL ELECTRIC WELDER ON FORDSON TRACTOR

An improved combination of an electric arc welder and a Fordson tractor has recently been developed by the General Electric Co., Schenectady, N. Y. The important improvements consist of a new type of welding equipment and the addition of head and tail lights, as well as a protective cover. The principal equipment consists of a standard Fordson tractor, which is belt-connected to a type WD-300-A, 25-volt, 300-ampere, one-hour rated, ball-bearing generator running at 1750 revolutions per minute. This unit is mounted directly on the tractor and is protected by a metal canopy and canvas side curtains. In addition to the contracting field, this equipment is useful in boiler shops, marine repair shops, and tank building plants.

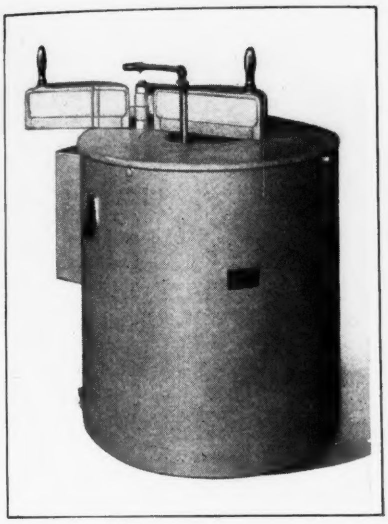
WAGNER AIR-JACKETED MOTORS

Air-jacketed motors designed for service where dust, fumes, and moisture are present in sufficient quantities to clog, corrode, short-circuit, or wear out the open-type of motor have been developed by the Wagner Electric Corporation, 6400 Plymouth Ave., St. Louis, Mo. These motors may also be used where inflammable fumes or dust are present. Each motor is surrounded by a jacket that is open at both ends. Fan blades are mounted on a shaft extension between the sealed motor and its outer jacket. These blades create a flow of cooling air around the motor through which foreign impurities cannot pass.

The motors are new in external construction only, no changes having been made in the electrical principles. The frame housing, the motor proper, and all bearings are substantially air-tight. Double-row ball bearings are provided. They are grease-lubricated and sealed in dustproof housings. Single-phase repulsion-induction motors of this air-jacketed design may be had in sizes of from 1 to 20 horsepower, and polyphase squirrel-cage motors, in sizes of from 2 to 30 horsepower.

GENERAL ELECTRIC LEAD-HARDENING FURNACES

A pot type of electric furnace for lead-hardening operations is being placed on the market in four sizes by the General Electric Co., Schenectady, N. Y. These furnaces are designed to operate at temperatures up to 1650 degrees F. and are intended for use in connection with the standard method of submerging work in a bath of molten lead. They are particularly suitable for hardening and tempering operations on chisels, files, drills, taps, dies, and other small tools or parts.



General Electric Pot Type of Lead-hardening Furnace

The four sizes cover a wide range of production conditions, the smallest having a maximum capacity of 75 pounds of steel per hour at 1500 degrees F. It has an inside pot diameter of 8 inches and an inside depth of 12 inches, while the over-all diameter is 32 inches, and the working height, 32 inches. The largest size has a maximum capacity of 250 pounds of steel per hour at 1500 degrees F. It has an inside diameter of 16 inches and an inside depth of 24 inches, while the outside diameter is 46 3/4 inches, and the working height 45 3/8 inches.

"LOGAN" ALUMINUM AIR CYLINDERS

Aluminum air cylinders designed for application to rotating spindles when light air cylinders are desirable have recently been developed by the Logansport Machine Co., 529 Market St., Logansport, Ind. A particular feature of these cylinders, in addition to their light weight, is that all packings are self-adjusting to prevent the escape of air. Fig. 1 shows the model K cylinder, which is of the same general design as the standard "Logan" model R cylinder, with the exception that all parts are made of aluminum, including the piston but, of course, excluding the shaft and packing. This cylinder is made in various sizes having bores from 4 1/2 to 16 inches in diameter. The weight of the 10-inch size complete is only 18 pounds.

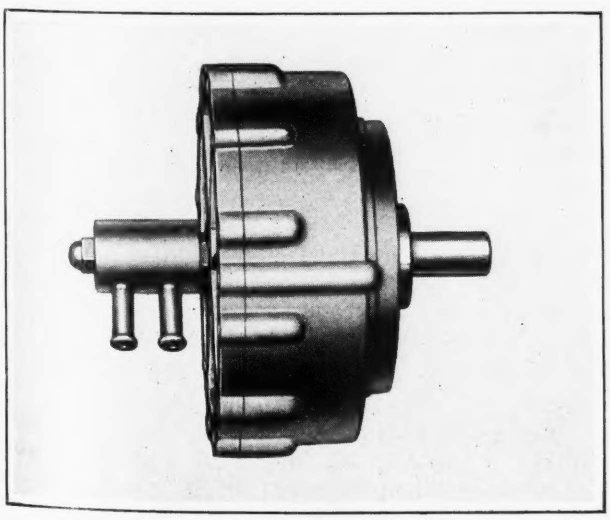


Fig. 1. "Logan" Aluminum Air Cylinder

Fig. 2 shows the model L cylinder, which is made in bore diameters of 1 1/2, 2, 2 1/2, and 3 inches for piston strokes of 1 inch or less. This cylinder is designed for use on small high-speed machines, and can be successfully used with speeds as high as 2000 revolutions per minute. The weight of a 1 1/2-inch cylinder is 3 1/2 pounds, and of a 3-inch cylinder, 7 pounds.

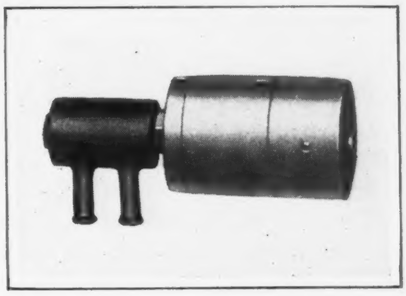


Fig. 2. Aluminum Air Cylinder for High-speed Machines

Both models K and L are equipped with a new type of air connection or "air shaft," which is also self-sealing through air pressure.

STERLING PROTECTED-TYPE MOTORS

"Cros-Line" starting motors of a "Klosd" construction in which there are no holes or openings where dust, dirt, grit, and water might collect are being placed on the market by Sterling Electric Motors, Inc., Telegraph Road and Atlantic Ave., Los Angeles, Cal. These motors may be used under any atmospheric condition in chemical plants, foundries, oil refineries, etc. They are made in sizes of from 1/4 to 30 horsepower for operation on three-phase alternating current, and from 1/4 to 5 horsepower in all speeds, for operation on single-phase alternating current. In single-phase motors, the condenser method of starting is used, and there are no switches, commutators, or brushes. All the motors are interchangeable for current of 220 or 440 volts. Either ball or roller bearings are provided. Full protection is furnished to windings, laminations, rotor, bearings, and other parts.

NEW MACHINERY AND TOOLS NOTES

Die-stock for Brass Pipe: Oster Mfg. Co., 2057 E. 61st Place, Cleveland, Ohio. A die-stock designed especially for threading brass pipe. This tool is equipped with automatic quick-opening dies, which eliminates the necessity of backing off the dies over finished threads. The dies can also be quickly adjusted for cutting deep or shallow threads. They are especially ground for cutting brass, having a slightly different cutting angle from that used on ordinary dies. A brass faceplate suitably marked enables the user to find this threader readily in shops where many die-stocks are in use.

Bolt Cold Header: E. J. Manville Machine Co., Waterbury, Conn. Three sizes of a single-stroke

solid-die cold header designed for producing plow bolt blanks and similar upset forgings. When the wire blank is pushed into the heading die of the machine and against the knock-out pin, that portion of the blank that projects unsupported in front of the die is forced into the die by the heading punch. A relief mechanism permits the knock-out pin to recede while the head is being formed. Fine adjustments for varying the length of bolt blanks are provided, and there is a cutting-off mechanism of improved construction.

Shears: Kutscheid Mfg. Co., 921 W. 49th Place, Chicago, Ill. Four sizes of shears having capacity for cutting mild steel 3/16 inch thick by 8 feet wide, 3/16 inch thick by 10 feet wide, 1/4 inch thick by 8 feet wide, and 1/4 inch thick by 10 feet wide, respectively. The housings, upper knife-bar, and bed are made of high-carbon steel plates, the upper knife-bar and the bed being of welded construction. Simplicity of operation and effective performance of the hold-down are features. Sectional or composite knives with one cutting edge are standard equipment, as well as front, side, and back gages. When the treadle is held in the depressed position, the upper knife-bar operates continuously. By means of a safety lever, the upper knife-bar can be stopped at any point during the stroke.

Hydraulic Testing Machine: Southwark Foundry & Machine Co., 1150 S. 4th St., Philadelphia, Pa. A large testing machine having a capacity of one million pounds, which has been built from designs of the Emery-Tatnall Co., for making both tension and compression tests. This machine has two columns or screws, and is operated by means of four hydraulic cylinders. There is a clear distance between the screws of 7 feet 1 inch. The fixed bed or upper platen is somewhat wider and has a length of 10 feet. Hydraulic power is furnished by a motor-driven Hele-Shaw pump. The ratio between the oil-cylinder plungers and the effective pump area being about 500 to 1, the full capacity of one million pounds is obtained with a total air pressure of 2000 pounds or a pressure of about 1000 pounds per square inch.

* * *

CORRECTION—UNION BENCH PUNCH PRESS

The description of the high-speed bench punch press recently developed by the Union Tool Co., 299 Norton St., Rochester, N. Y., which was published on page 554 of March MACHINERY, contained a typographical error. In the article it was stated that metal 1/64 inch thick could be punched to a diameter of 1 1/2 inches and that metal 3 3/32 inches thick could be punched to a diameter of 3/8 inch. The greater thickness mentioned in this statement should have been 3/32 inch, instead of 3 3/32 inches.

* * *

The traffic through the Panama Canal exceeds anything that was expected when the building of the Canal was taken over by the United States Government. In 1925, 4774 vessels passed through the Canal; in 1926, 5420; and in 1927, 6085 vessels used the Canal—an average of almost seventeen a day.

SHEET METAL, TUBING AND WIRE GAGES

By A. F. GERLACH, Chief Draftsman, American Laundry Machinery Co., Cincinnati, Ohio

The great number of existing gage systems is rather confusing, and one is often at a loss to know what system is employed for some particular kind of sheet metal, tubing, or wire. The accompanying table, compiled by the writer from data received

Gages for Sheet Metal, Tubing and Wire

Material	Gage
Sheet Metal	
Black Sheet Iron	U. S. Standard
Galvanized Sheet Iron	U. S. Standard
Blue Annealed Soft Steel	U. S. Standard
Steel Plate	U. S. Standard
Hot-rolled Sheet Steel	U. S. Standard
Cold-rolled Sheet Steel	U. S. Standard
Crucible Spring Sheet Steel	B. W.
Hoop Mild Steel	B. W.
Hot-rolled Monel Metal	U. S. Standard
Cold-rolled Monel Metal	U. S. Standard
Brass	B. & S.
Copper	B. W.
German Silver	B. & S.
Tubing	
Seamless Brass	B. W.
Brazed Brass	B. & S.
Seamless Copper	B. W.
Brazed Copper	B. & S.
Seamless Steel	B. W.
Aluminum	B. W.
Wire	
Lead	B. W.
Brass	B. & S.
Copper	B. & S.
Phosphor-bronze	B. & S.
German Silver	B. & S.
Iron	B. W.
Steel Spring or Steel	S. W. G.
Music	A. S. & W. Co.'s Music W. Ga.
Monel	B. & S.
Stubs Steel Wire or Drill Rod	Stubs Steel Wire Gage
Coil or Helical Steel Spring	S. W. G.

Machinery

B. W., Birmingham Wire; B. & S., Brown & Sharpe; A. S. & W. Co's Music W. Ga., American Steel & Wire Co's Music Wire Gage; S. W. G., Steel Wire Gage, same as Washburn & Moen.

from manufacturers of these materials, has proved a great help in eliminating confusion regarding the gage systems used. In specifying any of the materials, however, it is important that the decimal size be given. The system used for any given material can be determined from the accompanying table, and the decimal size of any number in that system can then be found by referring to tables such as are found in the sixth edition of MACHINERY'S HANDBOOK, pages 425 to 438.

* * *

It is proposed by the Department of Commerce that bumper heights on passenger cars, small motor coaches, and light delivery trucks be standardized at 18 inches above the ground at the front, and 19 inches above the ground at the rear, so that bumpers will not interlock, but the faces of the bumpers on two vehicles will meet when they come together. The over-all length of both front and rear bumpers on passenger cars is specified as 60 inches, and the vertical depth of the faces at 2 inches.

A NEW METHOD OF MAKING GUNS

By A. H. EMERY, Jr.

In the article in March MACHINERY "Making Big Guns at the Watertown Arsenal," it is mentioned that an entirely new method of gun manufacture has been worked out by the research staff of the Watertown Arsenal. Without in any way detracting from the research work done at the arsenal, the writer would like to point out that this method of gun construction was invented and patented by the late A. H. Emery of Stamford, Conn., patents being issued both in this country and abroad about 1903.

He was unable to interest either this or foreign governments in the process until 1918, when the Navy Department commissioned him to build a 4-inch gun by this process. This gun was built from a single forging, hydraulically expanded at the Bureau of Standards, using the Emery testing machine there for producing the necessary hydraulic pressure. It was finished at the Washington Navy Yard and satisfactorily tested at the Navy Proving Ground. Later, this method was adopted, and is now in use by the United States Navy.

It is interesting to note that after the United States entered the war it was found that the French had for some time been employing a method essentially the same as the Emery method for forging large field guns.

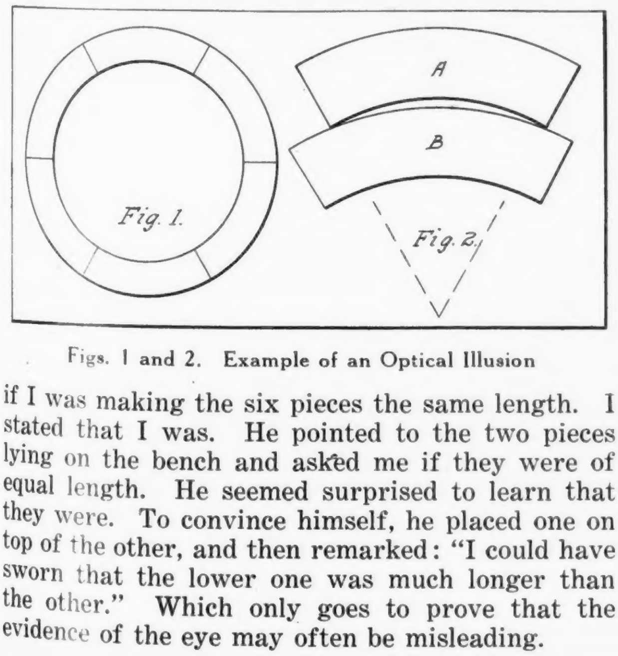
* * *

AN OPTICAL ILLUSION

By JIM HENDERSON

Some time ago the writer was engaged in making a wiring die for sheet-metal pails. The die was of the sectional type, made of six equal sectors, as shown in Fig. 1. These pieces were first cut from the forged ring, and afterward shaped on the sides and ends, the ends having an included angle of 60 degrees to make close fitting joints, giving an unbroken ring at the finishing diameter.

While filing the ends preparatory to assembling, two of the pieces lay on the bench in the position shown at *A* and *B* in Fig. 2. The foreman happened along, stopped for a moment, and inquired



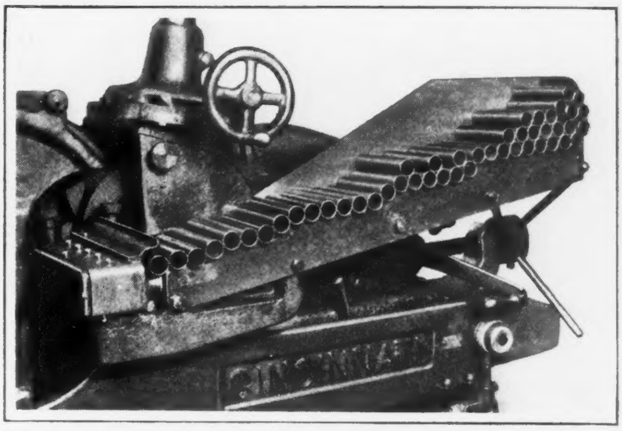
Figs. 1 and 2. Example of an Optical Illusion

if I was making the six pieces the same length. I stated that I was. He pointed to the two pieces lying on the bench and asked me if they were of equal length. He seemed surprised to learn that they were. To convince himself, he placed one on top of the other, and then remarked: "I could have sworn that the lower one was much longer than the other." Which only goes to prove that the evidence of the eye may often be misleading.

AUTOMATIC FEED FOR CENTERLESS GRINDER

At the machine shop practice meeting of the Chicago Section of the American Society of Mechanical Engineers on March 14, H. L. Blood, Chief of Machine Design Division, Western Electric Co., Hawthorne, Ill., described an ingenious device for feeding steel tubes into a centerless grinding machine.

The tubes are stacked in an inclined rack with a series of steps which keep the tubes parallel as they roll down the incline. The steps also have the



Automatic Feed Applied to a Cincinnati Centerless Grinder

effect of preventing any of the tubes from being carried along on top of others. The tubes roll one at a time on a series of grooved rollers which are driven by power derived from one of the shafts of the grinder.

As the weight of the tubes is not sufficient to provide the necessary traction for feeding them into the grinder, the rollers, which are of soft steel, are mounted on permanently magnetized studs. The frame which supports the studs is of bronze, and the studs are connected at the end opposite the rollers by a bar of soft steel. The studs are magnetized in such a way that alternate rollers are of different polarity. When a tube bridges the air gap between two adjacent rollers it completes the magnetic circuit, and the resulting traction between the tube and rollers is ample to feed the tube into the grinder.

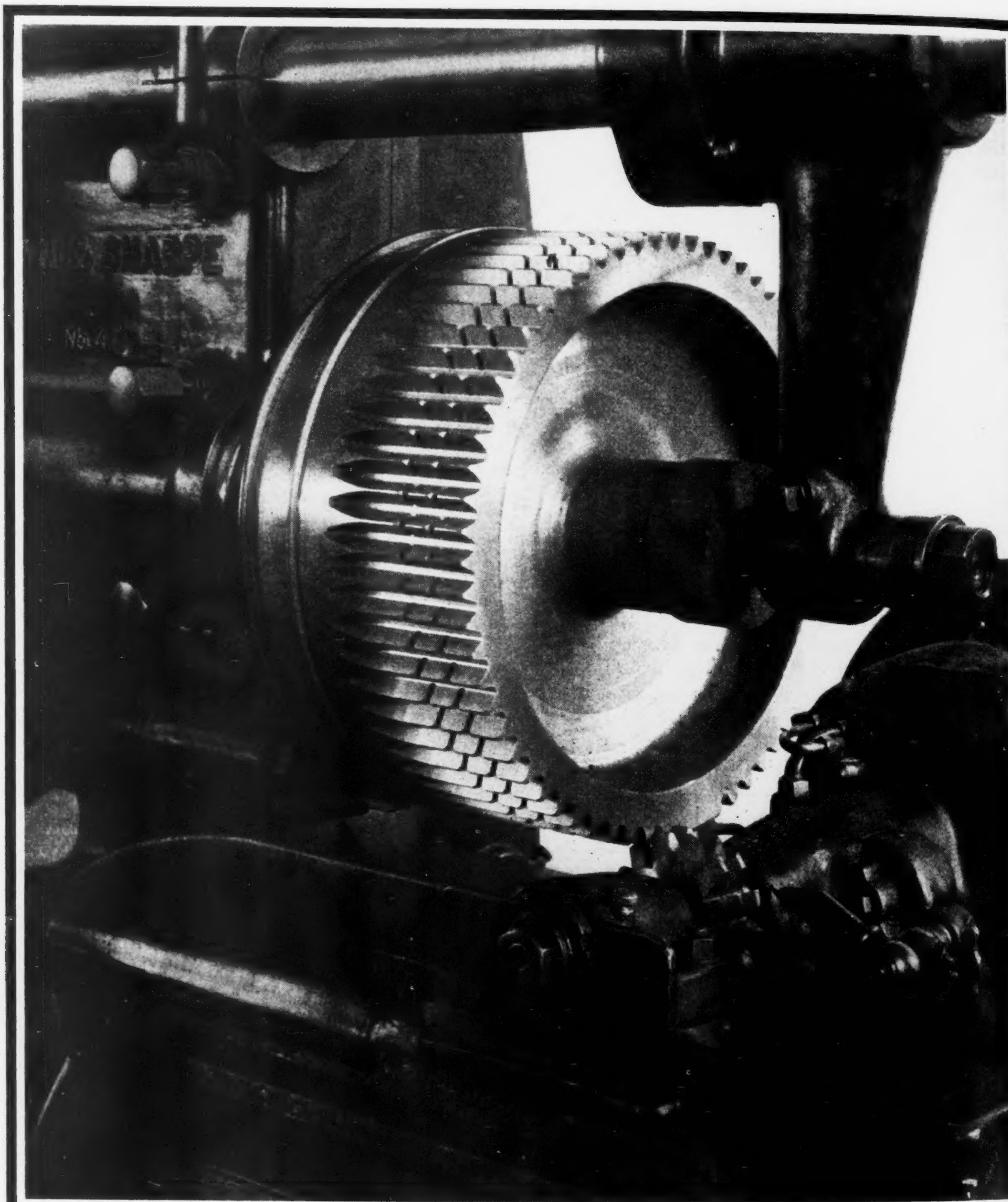
* * *

SYRACUSE MEETING OF AMERICAN SOCIETY FOR STEEL TREATING

The Syracuse local chapter of the American Society for Steel Treating held a meeting in that city March 12. An address was delivered by F. W. Manker, vice-president of the Surface Combustion Co., Toledo, Ohio, on "The Selection of Industrial Furnaces." In this address the factors to be considered in selecting industrial furnaces were outlined and details were given concerning furnaces utilizing gas, oil, and electricity as the heating medium. Operating data was furnished in connection with the performance of these different types of furnaces.

The methods that should be used in an industrial plant for obtaining a proper solution to its industrial furnace problems were outlined. The meeting was unusually well attended, indicating the great interest taken in the subject discussed.

BROAD RANGE — Gears, Clu



Cutting a silent chain sprocket on the No. 4 Automatic Gear Cutting Machine. Spur Gears up to 48″ dia. 10″ face can be cut on this machine.

THE BRITISH METAL-WORKING INDUSTRIES

From MACHINERY'S Special Correspondent

March 20, 1928

Industrial conditions in this country continue to improve, and a general air of optimism prevails. The foreign trade returns for January were distinctly encouraging; the imports, totaling £100,-389,225, showed a decrease of £5,000,431 as compared with the figures for December, while exports totalled £59,742,733, representing an increase of £908,809 as compared with December. The unemployment figures, too, indicate a steady improvement in industry generally.

The British Industries Fair was Well Attended

The British Industries Fair was held simultaneously in London and Birmingham from February 20 to March 2, and despite the large extensions provided since last year, exhibitors were accommodated with difficulty. The total floor space available this year amounted to 450,000 square feet, an increase of 100,000 square feet as compared with last year. The total number of exhibitors in London was about 1100 and in Birmingham 700. Another notable feature of this year's Fair was the greatly increased attendance of foreign buyers, the total being estimated at between 200 and 300 per cent greater than last year.

At Birmingham, where the heavy mechanical and electrical engineering sections were concentrated, together with hollow-ware, hardware, and similar trades, the electrical exhibits were particularly comprehensive. Power plant and prime movers were also conspicuous, and a collective exhibit of a group of prominent Halifax machine tool makers represented an important innovation, since it was the first really comprehensive display of machine tools shown at the British Industries Fair. So far as can be ascertained at present the number of orders booked by exhibitors has proved very satisfactory, the orders obtained by exhibitors at the London section of the Fair exceeding by more than 50 per cent those obtained last year.

At the Leipzig Spring Fair which opened on March 4, the number of British firms exhibiting reached the record of 65, being two more than last year's attendance which was then a record.

Machine Tool Industry Continues to Progress

The machine tool industry continues to make steady progress, and most firms are able to report satisfactory orders, while a few have sufficient work in hand to tax their capacity for some months. It is encouraging to note that, whereas a year ago many machine tool builders were almost solely dependent on the automobile industry for orders, other sections of the engineering industry are now responsible for a large percentage of the business booked. Even shipbuilding firms who have hitherto been carrying on with old equipment in view of the uncertainty of the general outlook, are beginning to place orders. The small tool industry is in a healthier state than it has been for many months.

Overseas Trade in Machine Tools Shows Increase

The returns for January indicate rather complex changes in the overseas trade in machine tools. Exports are somewhat low in tonnage, with a marked rise in ton value. Imports are much higher in tonnage, with a fall in ton value. The actual export figures for January show that 1159 tons of machine tools were exported, the total value being £148,239 with a ton value of £128. The corresponding figures for December were 969 tons, valued at £113,-318, with a ton value of £117, and for November 2018 tons, valued at £197,581, with a ton value of only £98. The January imports totalled 921 tons, valued at £133,822, with a ton value of £145. The corresponding figures for December were 595 tons, valued at £89,894, with a ton value of £151, and for November 707 tons, valued at £109,180, with a corresponding ton value of £154. Exports of tools and cutters during January amounted to £51,250, as compared with £51,906 in December, and £60,003 in November.

General Industrial Conditions are Good

Firms engaged in electrical engineering, particularly the heavy sections of the industry, continue to be well employed. Generally, railway engineering firms are also well employed, and some large contracts have been obtained recently. In the shipbuilding industry, some important contracts have recently been placed.

The total production of pig iron in the United Kingdom during January amounted to 560,500 tons, as compared with 559,100 tons in December and 434,600 tons in January, 1927. The production of steel in January amounted to 626,200 tons, as compared with 604,900 tons in December and 730,700 tons in January, 1927.

* * *

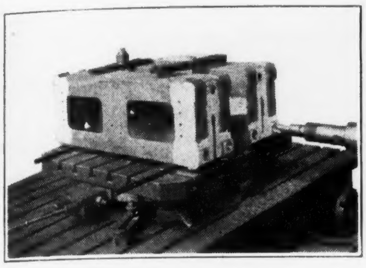
RAPID PRODUCTION OF AUTOMOBILE FRAMES

Many interesting details relating to the automatic production of automobile frames in the plant of the A. O. Smith Corporation, Milwaukee, Wis., were given in a paper by John P. Kelley read before the Detroit Section meeting of the Society of Automotive Engineers. This plant may be described as a huge automatic machine in which all the equipment is co-related from the feeding-in end of the sheet steel to the emerging of the completed frame. The total time required from the first operation on the raw material to the enameling of the finished frame is 1 hour 50 minutes. The plant has a daily capacity of over 7000 frames.

In spite of the fact that the entire equipment is automatic and must be suited to the particular size of automobile frame made, it is possible in a comparatively short time to change the entire plant so as to adapt it to the production of another type or size of frame. The changing over can be done in ten hours by a force of two hundred men.

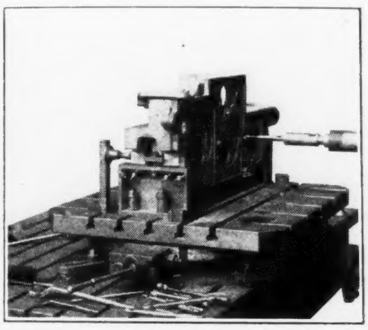
The construction of this plant presented a huge engineering problem since there was no installation in existence that could be used as a guide. On the average frame there are 550 operations, all of which had to be synchronized so that the work would move smoothly from the raw material to the finished product. The speed at which the frames are turned out is 360 per hour. In other words, a frame emerges from the delivery chute every ten seconds.

Performance That Talks



Grey Iron Casting 12" wide, 18" high, 4' long, mounted on a 48" revolving table and drilled from four positions with the one set-up.

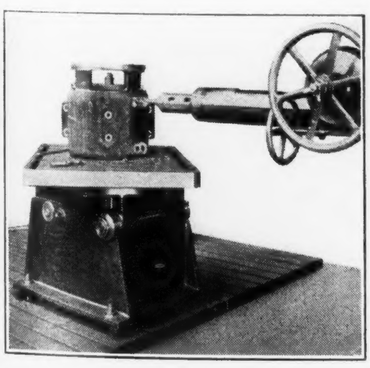
Four 1¾" holes drilled thru 1" material. Two 1¾" holes drilled and reamed through ½" material. Eight 11/16" holes drilled through ⅝" material. Fixed column type Ryerson Horizontal Drill used.



Drilling a cast iron trolley side, with jig. Mounted on a 4' revolving table. Weight of casting 900 lbs.; of jig 205 lbs.

Thirteen ¾" bolt holes drilled and spot faced through 1½" material.

Two 1½" holes drilled and reamed through 3¼" material. Number 11 Ryerson Horizontal Drilling and Boring Machine used.



Drilling, Spot Facing and Back Facing Motor Frame on No. 12 Horizontal Drilling and Boring Machine. Work clamped on Universal Tilting and Revolving Table.

Material—Cast Steel—Weight—468 lbs.

4 Holes 1-5/32" drilled thru 1¼" metal and back faced. 8 Holes 49/64" drilled thru ½" metal and back faced. 4 Holes ⅞" drilled thru 1⅝" metal and back faced.

Drill it → Horizontally

And Save Set-Up Time

Have the next job set while the drill is busy. Use a simple, easily handled, rotary table and work four sides of a casting from the one setting. Or use a universal rotary and tilting table and work five sides from any angle at the one setting. You can save set-up time and greatly increase production with a Ryerson Horizontal.

Save Small Tools

When the drill point breaks through, there is no sudden spring that snaps the tool. Drilling pressure is against a heavy vertical column. Horizontal Drilling allows the chips to work out of the holes and gives more holes per drill grinding.

Drill Holes Cleaner and Faster

Finish the hole without stopping to pull out the drill and clean away the chips. They work out through the spiral of the drill and drop to the floor away from the work.

Get Continuous Production

The operator of a Ryerson Horizontal can plant his feet in one spot and bring the machine and work to him. He does not have to climb around and over odd-shaped castings all day. His energy goes into additional work and he is able to keep up production as the day grows.

Handle a Wider Range of Work

Small pieces on a production schedule, or the largest castings—in fact, anything in the shop—can be economically handled by the horizontal. The flexible arrangement of the Ryerson Horizontal permits work over an exceptionally wide range.

Check up the possible savings in your shop. Investigate the Horizontal. Our engineers will be glad to work with you. Ask for Bulletin 4051.

JOSEPH T. RYERSON & SON INC.

ESTABLISHED 1842

Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Pittsburgh, Philadelphia, Boston, Jersey City, New York, Richmond, Houston, Tulsa, Los Angeles, San Francisco, Denver, Minneapolis, Duluth

RYERSON

MACHINERY-SERVICE

OBITUARIES

Anthony L. Herkenhoff, general manager of the Minster Machine Co., Minster, Ohio, and for a period of thirty years prominent in the machinery industry of the country, died suddenly of an acute heart attack on Tuesday, February 21, at Sidney, Ohio, while on a business trip. Mr. Herkenhoff was born at Minster, Ohio, in 1872. He attended the Minster Public School, and later St. Mary's Institute at Dayton, Ohio, now the Dayton University. After being employed at the Atlas Engine Co. at Indianapolis for a period of years, he was instrumental in organizing the Minster Machine Co. in 1898, serving as its general manager from that time until his death. In 1916 he, with some of his business associates, organized the St. Mary's Foundry Co. at St. Mary's, Ohio, of which he was vice-president and manager. In 1918 the Streine Tool & Mfg. Co. of New Bremen, Ohio, was similarly organized, and he served as president of that company from the time of its organization. Fraternally, he was associated with the Knights of Columbus. He was also one of the charter members and enthusiastic organizers of the present Minster Commercial Club, and was very prominent in civic affairs throughout his entire life. He leaves a wife and two sons, John F. and Victor, the oldest of whom, John F., is now associated with the Minster Machine Co. as its sales manager.

Newton S. Calhoun, president of the Johnston & Jennings Co., Cleveland, Ohio, since 1905, died recently at Pasadena, Cal. Mr. Calhoun was born in Connecticut seventy-three years ago, and was educated at the Suffield Academy and Brown University, from which he graduated in 1879. He went to Cleveland in 1882, where he practiced law until he began to devote himself to the industrial field.

Albert A. Dowd, consulting engineer and a well-known contributor to Machinery's pages for many years, died in Detroit, Mich., March 15 of pneumonia. In his earlier years, Mr. Dowd was engaged in the machine tool field, being employed by the Pratt & Whitney Co., Hartford, Conn., and the Bullard Machine Tool Co., Bridgeport, Conn. Later, he engaged in consulting engineering work, mainly in the design of special machines and equipment for quantity manufacture. Readers of Machinery will recollect the series of articles on tools, chucks, and fixtures and on special automatic machinery that was published in Machinery some years ago.

PERSONALS

P. R. Hoopes, consulting mechanical engineer, of Hartford, Conn., is spending a few weeks in Germany on business.

E. O. Johnstone, district sales manager for the American Chain Co., Inc., 425 Second St., San Francisco, Cal., has been appointed Pacific Coast distributor of Ford chain hoists made by the Ford Chain Block Co., Philadelphia, Pa.

Edward H. Ingram has been appointed general superintendent and works manager of the Automatic Nut-Thread Corporation, 3617 N. 8th St., Philadelphia, Pa. Mr. Ingram was formerly connected with the Landis Tool Co., of Waynesboro, Pa.

Myron F. Westover, secretary of the General Electric Co., Schenectady, N. Y., for the last thirty-four years, retired on March 1, and William W. Trench, assistant secretary, was elected by the board of directors to succeed him. Mr. Westover has been actively identified with the electrical industry for forty years.

T. F. Scannell has been appointed exclusive representative for the complete line of magnetic separation equipment, magnetic clutches, etc., made by the Magnetic Mfg. Co., Milwaukee, Wis. Mr. Scannell was formerly connected with the Chain Belt Co., of Milwaukee. His office will be located at 502 Ambassador Building, Milwaukee.

W. G. Prasse has been appointed representative in the New York district of the Oilgear Co., Milwaukee, Wis., manufacturer of Oilgear broaching machines, hydraulic presses, variable-speed transmissions, machine tool feeds, etc. Mr. Prasse's headquarters will be at the New York offices of the company, 342 Madison Ave., New York City.

W. G. Nichol, who formerly was direct factory sales representative of the Barnes Drill Co., Rockford, Ill., in Connecticut and western Massachusetts, has been transferred to the sales department at the office of the company in Rockford. The sales work in the East that formerly was taken care of by Mr. Nichol is now handled by Arthur S. Pierce of 35 Laurel St., Melrose (Boston), Mass.

Hermann Hofmann, of the firm of Ludwig Kaufmann & Co., machine tool dealers in Frankfurt a/M., Germany, recently returned to Germany after having spent several months in the factory of the Barnes Drill Co., Rockford, Ill., receiving training in the setting up and demonstration of the machines built by this company. The Ludwig Kaufmann Co. represents the Barnes Drill Co. in Germany.

E. Garfield Andrews, 79 Queen St., Ashfield, Sydney, New South Wales, Australia, manufacturer of quarrying machinery of different kinds, contemplates the extension of his plant and is interested in receiving catalogues and other necessary information on machine tools used in the building of quarrying machinery. He would also like catalogues and quotations for machinery needed for a complete plant for the manufacture of cylinder-type pneumatic hoists.

Four General Electric men have been named members of the American committee of the World Congress of Engineers to be held in Tokio, Japan, in November, 1929. These are E. W. Rice, Jr., honorary chairman of the board; Gerard Swope, president; C. C. Chesney, vice-president, and Professor Elihu Thomson, director of the Thomson research laboratory of the company. The appointments were made by Secretary of Commerce Herbert Hoover.

W. W. Nichols, vice-president and mechanical engineer of D. P. Brown & Co., 1440 Park Place, Detroit, Mich., has recently been honored by having conferred upon him membership in the Masaryk Academy of Work of Prague, Czechoslovakia. This makes the second membership in foreign engineering societies recently conferred upon Mr. Nichols, as he previously was admitted to membership in the Institute of Scientific Management of Warsaw, Poland.

William B. Updegraff was elected vice-president in charge of sales of the Watson-Stillman Co., 75 West St., New York City, at a recent meeting of the board of directors. For the last fifteen years, Mr. Updegraff has been engaged in various engineering and sales capacities with this company. As a graduate of Harvard University, he has been actively interested in the Harvard Engineering Society, and he is also a member of the American Society of Mechanical Engineers.

R. C. Bastress, formerly with the Fort Wayne Iron Store Co., has joined the Black & Decker Mfg. Co., Towson Heights, Baltimore, Md., and will have charge of sales in Indiana and part of Michigan. L. W. Beuhausen, formerly with Slocum & Kilburn, will handle Black & Decker products through western Massachusetts. G. N. McCarthy will represent the Black & Decker Mfg. Co. in the Buffalo territory, taking the place of H. B. Austin who has been transferred to the Chicago district.

T. A. Hyde was elected a vice-president of the Henry G. Thompson & Son Co., New Haven, Conn., manufacturer of "Milford" and "Mil Flex" hacksaw blades, at the recent annual meeting of the company. A. W. Tucker was elected secretary. Mr. Hyde has just taken charge of the New York territory, including the export business in New York, with offices at 126 Chambers St., and Mr. Tucker has been placed in charge of the home office at New Haven, Conn. The other officers of the company remain the same, namely: President, D. W. Northrup; vice-president, Fellowes Thompson; and treasurer, D. C. Smyth.

* * *

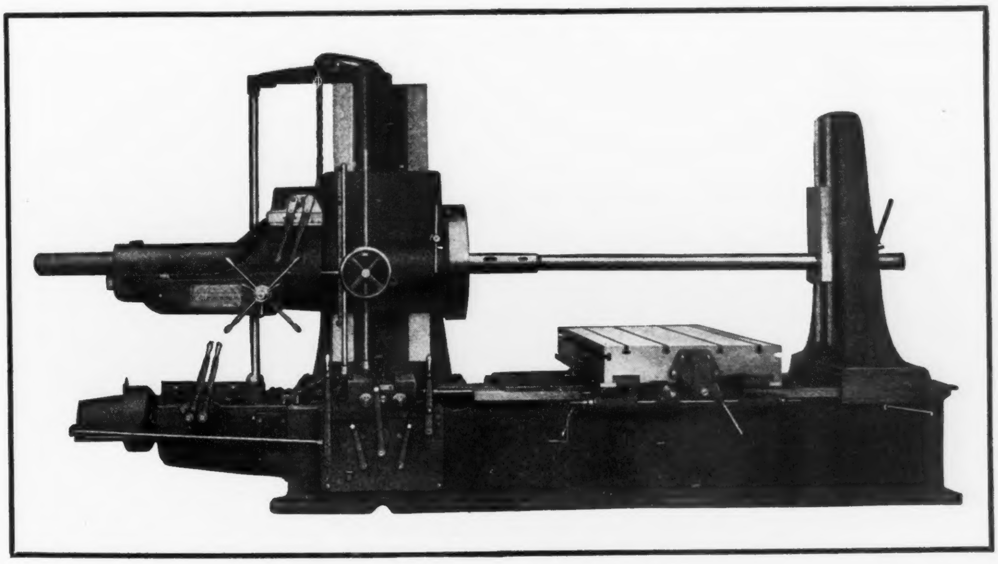
A recent number of *Engineering* states that the world's latest record for altitude was reached on December 21 by the Italian pilot, Donati, when he reached a height of 38,800 feet. He used an airplane fitted with the Jupiter air-cooled static-radial engine. The temperature of the air recorded at this altitude was 76 degrees F. below zero.

"One of the most expensive things in business is INDECISION."
Business has taken an upward start, therefore

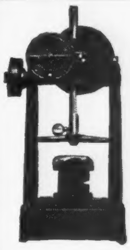
Get a LUCAS

"PRECISION"

Horizontal Boring, Drilling and MILLING MACHINE



while the getting is good.



WE ALSO MAKE THE
LUCAS POWER
Forcing Press

THE LUCAS MACHINE TOOL CO., Cleveland, Ohio, U. S. A.

FOREIGN AGENTS: Alfred Herbert, Ltd., Coventry, Societe Anonyme Belge, Alfred Herbert, Brussels. Allied Machinery Co., Barcelona, Zurich. V. Lowener, Copenhagen, Oslo, Stockholm. R. S. Stokvis & Zonen, Paris and Rotterdam. Andrews & George Co., Tokyo. Ing. M. Kocian & G. Nedela, Prague. Emanuele Mascherpa, Milan, Italy.

TRADE NOTES

UNITED STATES ELECTRICAL TOOL CO., 2477 W. Sixth St., Cincinnati, Ohio, announces the opening of a new branch office in Syracuse, N. Y., 205 University Bldg. H. N. Kelsey is in charge of the new office.

JULIAN J. BEHR CO., INC., Cincinnati, Ohio, advertising agency, announces that an eastern office has been opened at 93 Fifth Ave., New York City, with M. A. Abel, manager, and Julius Joseph, Jr., assistant manager.

KEMPSMITH MFG. CO., Milwaukee, Wis., manufacturer of milling machines and milling machine equipment, has established its own export office in the Graybar Bldg., New York City. Paul H. Petersen will act as export manager.

AHLBERG BEARING CO., 317 E. Twenty-ninth St., Chicago, Ill., has opened a new branch office at 902 Main St., Buffalo, N. Y. H. C. Petzing, who has long been affiliated with the company in the capacity of manager at Columbus, Ohio, will be in charge of the new branch.

LOUIS ALLIS CO., Milwaukee, Wis., manufacturer of direct- and alternating-current motors, has opened a district sales office in Cleveland, Ohio. W. F. Glaser has been appointed district sales manager, and is located at Room 409, Union Bldg., 1836 Euclid Ave., Cleveland.

C. H. GOSIGER MACHINERY CO., 413 W. 5th St., Dayton, Ohio, machine tool dealer, is erecting a new one-story office and warehouse building, of brick and steel structure, 110 by 148 feet, on Bacon and McDonough Sts. The new building will be used for warehouse, office, and display purposes.

FAFNIR BEARING CO., New Britain, Conn., announces that the new Libby heavy-duty turret lathe, built by the International Machine Tool Co., Indianapolis, Ind., is completely provided with ball bearings made by the company, as follows: 13 sets in the headstock, 32 in the apron, 15 in the rapid traverse, and 2 in the idler pulleys.

WORTHINGTON PUMP & MACHINERY CORPORATION announces that its executive offices, as well as its export sales department and New York district sales department, are being moved to 2 Park Ave., New York City, April 1. The head office sales and advertising departments of the company have been moved to the Harrison plant at 421 Worthington Ave.

SHAW CRANE-PUTNAM MACHINE CO., INC., which is owned by MANNING, MAXWELL & MOORE, INC., announces the purchase of the Lamb & Nash line of sheet-metal machines, which includes rotary gang slitting machines and squaring shears. In the future, these machines will all be manufactured at the Putnam Works of the Shaw Crane-Putnam Machine Co., Inc., Fitchburg, Mass.

BOSTON GEAR WORKS SALES CO., Norfolk Downs, Mass., has taken over the exclusive distribution of Duckworth industrial chains in the United States, with the exception of the Pacific Coast territory. Complete stocks of these chains, with a wide variety of sprockets, will be available at the company's factory branches at 34 Oliver St., Boston, Mass.; 151 Lafayette St., New York City; 11th and Arch Sts., Philadelphia, Pa.; 1450 W. Third St., Cleveland, Ohio, and 955 W. Washington Blvd., Chicago, Ill.

MONARCH TRACTORS CORPORATION, Springfield, Ill., has been purchased by the ALLIS-CHALMERS MFG. CO., Milwaukee, Wis. The Monarch tractors will continue to be manufactured in Springfield, and the business will be carried on under the name of MONARCH TRACTORS CORPORATION, SUBSIDIARY OF ALLIS-CHALMERS MFG. CO. No changes are planned in the general factory and office organizations, R. W. Gotshall remaining president and H. B. Baker, sales manager. Arrangements have been made to install additional machinery and equipment in the Springfield plant in order to increase the rate of production.

DIAMOND MOTOR PARTS CO., St. Cloud, Minn., has taken over the GILL MFG. CO., of Chicago, and the SCHLIEDER MFG. CO. of Detroit and Milford. The former company has been manufacturing piston-rings, and the latter has been supplying valves to the automobile industry for the last sixteen years. George G. Bouthinon is president, treasurer, and general manager of the corporation. E. J. Smith, formerly president of the Gill Mfg. Co., is vice-president, and will be in charge of sales. V. W. Schlieder, formerly vice-president of the Schlieder Mfg. Co., is secretary, and will be in charge of the equipment division. All the machinery, equipment, and stock of the two plants have been moved to the Diamond plant at St. Cloud.

LARKIN PACKER CO., 6200 Maple Ave., St. Louis, Mo., announces the purchase of all the property and assets of the DAVIS BORING TOOL CO., INC., including the company's plant at 3693 Forest Park Blvd., St. Louis, Mo. The Larkin Packer Co. was founded in 1905 to engage in the manufacture of oil-well supplies. Recently the company began to manufacture expansion boring-bars and cutters, and the acquisition of the Davis Boring Tool Co.—with the combined facilities of both plants—assures increased facilities in this field. The Davis Boring Tool Co. will remain as a division of the Larkin Packer Co., and will continue to occupy its present plant. The general offices will be at the Larkin plant, 6200 Maple Ave. J. J. Larkin, sole proprietor, will be the active head of both concerns. J. E. Kilzer, who developed the Larkin expansion boring-bar, will continue as assistant general manager in charge of operations.

COMING EVENTS

APRIL 19-21—Twelfth annual meeting of the American Gear Manufacturers' Association to be held at the Hotel Seneca, Rochester, N. Y. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland, Ohio.

APRIL 23-24—Meeting of the Materials Handling Division of the American Society of Mechanical Engineers at the Hotel Benjamin Franklin, Philadelphia, Pa. Further information may be obtained by addressing the Materials Handling Division, American Society of Mechanical Engineers, 29 W. 39th St., New York City.

APRIL 25-26—Annual convention of the National Metal Trades Association at the Hotel Astor, New York City. Homer D. Sayre, commissioner, Peoples Gas Bldg., Chicago, Ill.

APRIL 25-27—Annual meeting of the American Welding Society at the headquarters, 33 W. 39th St., New York City. M. M. Kelly, secretary.

APRIL 25-27—Fifteenth National Foreign Trade Convention in Houston, Tex. O. K. Davis, secretary, National Foreign Trade Council, India House, Hanover Square, New York City.

MAY 14-17—Spring meeting of the American Society of Mechanical Engineers in Pittsburgh, Pa. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

MAY 14-18—Twenty-first annual exhibit of machines, equipment, materials and supplies for foundries and the allied industries in the Commercial Museum, Philadelphia, Pa. In conjunction with the exhibit, the thirty-second annual convention of the American Foundrymen's Association will be held. C. E. Hoyt, manager of exhibits, 140 S. Dearborn St., Chicago, Ill.

MAY 25-26—Fifth annual convention of the National Association of Foremen to be held at Canton, Ohio. E. H. Tingley, secretary, National Association of Foremen, 1249 U. B. Bldg., Dayton, Ohio.

JUNE 4-6—Fourteenth annual convention of the American Association of Engineers at El Paso, Tex.; headquarters, Hotel Hussman. Chairman of local committee, L. M. Lawson, First National Bank, El Paso, Tex. Further information can be obtained from the secretary, M. E. McIver, 63 E. Adams St., Chicago, Ill.

JUNE 13-20—Annual meeting of the Mechanical Division V of the American Railway Association in Atlantic City, N. J.

JUNE 13-20—Annual convention and exhibition of the Railway Supply Manufacturers' Association in Atlantic City, N. J. Secretary-treasurer, J. D. Conway, 1841 Oliver Bldg., Pittsburgh, Pa.

JUNE 14-16—Oil and Gas Power meeting of the American Society of Mechanical Engineers at State College, Pa. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

JUNE 25-29—Annual meeting of the American Society for Testing Materials at Atlantic City, N. J.; headquarters, Chalfonte-Haddon Hall Hotel. Secretary, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

JUNE 25-29—Annual meeting of the Society for the Promotion of Engineering Education at the University of North Carolina, Chapel Hill, N. C. For further information, address Dean Braune, University of North Carolina.

JUNE 26-29—Semi-annual meeting of the Society of Automotive Engineers at the Chateau Frontenac, Quebec, Canada. Coker F. Clarkson, secretary, 29 W. 39th St., New York City.

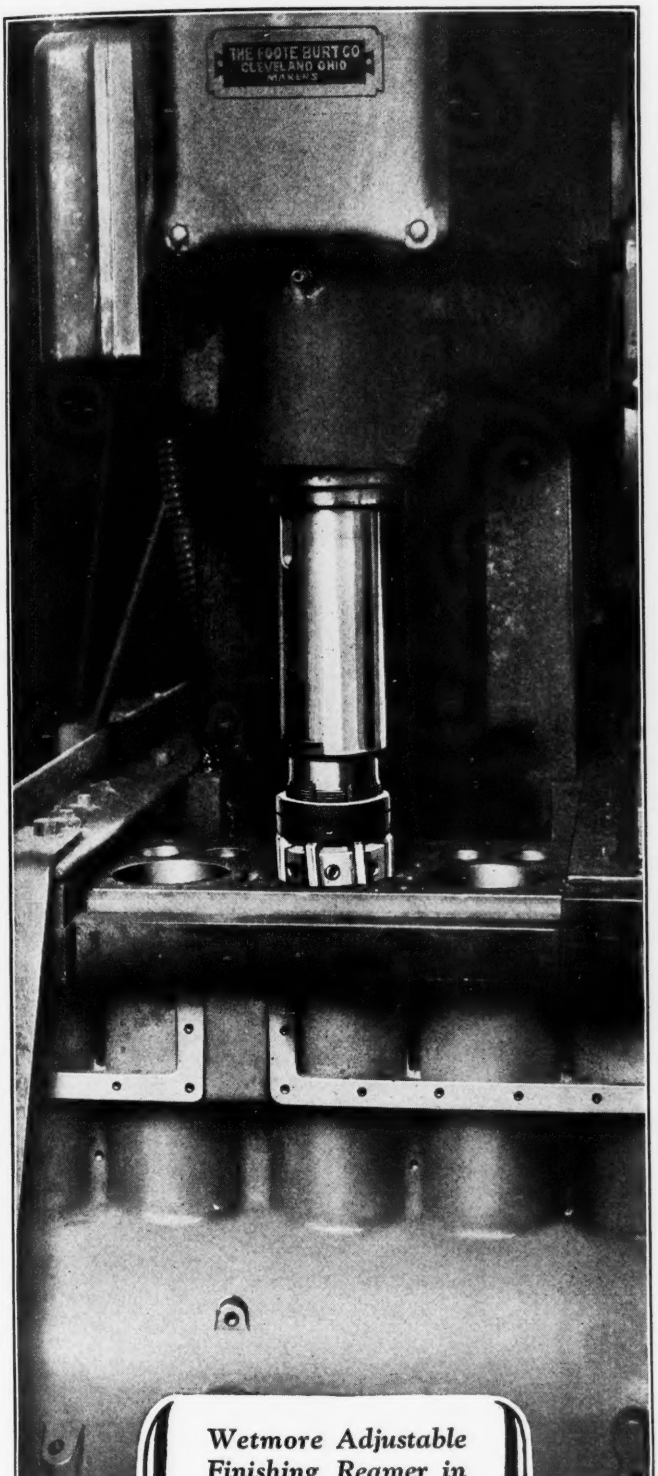
JUNE 28-29—Aeronautic Division meeting of the American Society of Mechanical Engineers at Detroit, Mich. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

AUGUST 27-29—Regional meeting of the American Society of Mechanical Engineers at St. Paul-Minneapolis, Minn. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

SEPTEMBER 5-22—Fourth Machine Tool and Engineering Exhibition to be held at Olympia, London, England.

SEPTEMBER 12-14—Annual convention of the American Railway Tool Foreman's Association in Chicago, Ill.; headquarters, Hotel Sherman. Secretary and treasurer, F. A. Armstrong, 564 W. Monroe St., Chicago, Ill.

SEPTEMBER 17-20—Second national meeting of the Fuels Division of the American Society of Mechanical Engineers to be held in Cleveland, Ohio. Chairman of Fuels Division, Victor J. Azbe, American Society of Mechanical Engineers, 29 W. 39th St., New York City.



Wetmore Adjustable Finishing Reamer in use on motor block in one of the large, well-known Detroit automobile plants.

Why the Big Motor Manufacturers *prefer the* WETMORE

THERE are several reasons why many of the largest automobile manufacturers in Detroit and other cities use *Wetmore Adjustable Cylinder Reamers* as standard equipment.

These manufacturers know by tests and comparisons that the Wetmore has *greater durability,* due to its sturdier construction. Also that it permits a *faster working speed,* with *no vibration.*

Wetmore Cylinder Reamer Sets (Roughing reamer, Semi-finishing reamer, Finishing reamer) are built for strenuous service. Their long life means economy. The Roughing reamer is extremely rugged. The Semi-finishing reamer, with its left-hand angle blades, eliminates digging in and chattering. It assures a straight, round hole with no scoring. The construction of the Finishing reamer assures a smooth, glass-like finish to the cylinder wall.

Give Wetmore Cylinder Reamers a trial in your shop. Compare them on a production and economy basis with any other reamers. They will prove their superiorities to you, just as they have to others.

Send for Catalog No. 26, showing full line of Wetmore Adjustable Reamers, including standard, heavy-duty, shell, small machine and cylinder reamers. Also arbors and replacement blades.

WETMORE REAMER COMPANY
60-27th Street Milwaukee, Wis.

WETMORE ADJUSTABLE REAMERS

"THE BETTER REAMER"

OCTOBER 1-3—"New England Industries" meeting of the American Society of Mechanical Engineers at Boston, Mass. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

OCTOBER 8-12—Annual convention of the American Society for Steel Treating, to be held in conjunction with the tenth National Metal Exposition at Philadelphia, Pa. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland.

OCTOBER 22-25—Machine Shop Practice meeting of the American Society of Mechanical Engineers at Cincinnati, Ohio. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

OCTOBER 25-26—Management Division meeting of the American Society of Mechanical Engineers at Columbus, Ohio. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

JANUARY 14-18, 1929—Western Metal Congress and Western States Metal and Machine Tool Exposition to be held in the Shrine Auditorium, Los Angeles, Cal., under the auspices of the American Society for Steel Treating, 7016 Euclid Ave., Cleveland, Ohio.

NEW BOOKS AND PAMPHLETS

ECONOMIC STATISTICS OF THE SOVIET UNION. 78 pages, 4 by 5½ inches. Issued by the Amtorg Trading Corporation, 165 Broadway, New York City.

THE SUPERIORITY OF ACETYLENE AS A FUEL GAS FOR CUTTING. 23 pages, 5¼ by 9 inches. Distributed by the International Acetylene Association, 30 E. 42nd St., New York City.

NATIONAL ELECTRICAL SAFETY CODE. 525 pages, 5¼ by 7¾ inches. Published by the United States Department of Commerce, Washington, D. C., as No. 3 of the Handbook Series of the Bureau of Standards. Price, $1.

LIGHT METALS AND ALLOYS (ALUMINUM AND MAGNESIUM) 403 pages, 7 by 10 inches. Published by the United States Department of Commerce, Washington, D. C., as Circular No. 346 of the Bureau of Standards. Price, $1.10.

ELIMINATION OF WASTE (FORGED TOOLS). 24 pages, 6 by 9 inches. Published by the United States Department of Commerce, Washington, D. C., as Simplified Practice Recommendation No. 17 of the Bureau of Standards. Price, 5 cents.

PROCEEDINGS OF THE FIFTEENTH ANNUAL CONVENTION OF THE AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION. 160 pages, 5½ by 8½ inches. Obtainable from the Secretary-Treasurer of the association, G. G. Macina, 11402 Calumet Ave., Chicago, Ill. Price, $2.50.

SUPERHEAT ENGINEERING DATA. 254 pages, 4 1/2 by 7 inches. Published by the Superheater Co., 17 E. 42nd St., New York City. Price, $1.

This is the seventh edition of a handbook on the generation and use of superheated steam and related subjects. It contains condensed data, carefully indexed for ready reference. One of the valuable features of the book is the section containing steam tables giving properties of saturated and superheated steam to 3300 pounds absolute pressure.

MECHANICAL DRAFTING HANDBOOK. By Frank R. Kepler. 127 pages, 6 by 9 inches. Published by the Bruce Publishing Co., 354 Milwaukee St., Milwaukee, Wis. Price, 60 cents.

This book is intended to provide students and mechanical draftsmen with essential information on standards, conventions, and methods employed in modern drafting-room practice. Part I deals with the fundamental principles of mechanical drawing and lettering, as well as with the use and care of instruments. Part II treats of standards and conventions. Part III contains tables of screws and nuts, tap drills, etc.

NEW CATALOGUES AND CIRCULARS

CONVEYORS. Industrial Conveyor Co., Keyport, N. J. Bulletin illustrating industrial flexible metal conveyor belts.

WELDING EQUIPMENT. Lincoln Electric Co., Cleveland, Ohio. Bulletin listing supplies for Lincoln "Stable-arc" welders, including welding electrodes, rods, holders, etc.

NICKEL ALLOY RESISTORS. Electric Controller & Mfg. Co., Cleveland, Ohio. Circular containing information on electrical resistors made of nickel alloy for use in rigorous service.

ELECTRIC EQUIPMENT. Allen-Bradley Co., 499 Clinton St., Milwaukee, Wis. Bulletins 209, 211, 640, 704, 709, 710, 720, and 800, illustrating and describing starting and reversing switches.

NICKEL STEEL. International Nickel Co., Inc., 67 Wall St., New York City. Buyers' Guide, containing a classified list of names of manufacturers of monel metal and pure nickel products.

MOTORS. Lincoln Electric Co., Cleveland, Ohio. Catalogue illustrating and describing in detail the "Link-Weld" induction motors which are constructed of steel and welded at many different points.

BALL BEARINGS. New Departure Mfg. Co., Bristol, Conn. Circulars Nos. 185 FE and 186 FE, illustrating installations of ball bearings in radial drill gear-boxes and planer-drive shafts, respectively.

DIE-CASTING MACHINES. Madison-Kipp Corporation, Madison, Wis. Circular comprising a reprint of a description of the Madison-Kipp die-casting machine from the February number of MACHINERY.

FLOODLIGHTING EQUIPMENT. Crouse-Hinds Co., Syracuse, N. Y. Pamphlet entitled "Floodlights and Industrial Units," illustrating various types of floodlight projectors for industrial and other lighting purposes.

WRENCHES. Husky Wrench Co., Milwaukee, Wis. Condensed catalogue 28 listing the Husky line of interchangeable-socket wrenches and soft-tip hammers. Copies will be sent to those interested, upon request.

GEAR-GRINDING CHUCK. City Machine & Tool Works, 1521 E. 3rd St., Dayton, Ohio. Bulletin BC-1, illustrating and describing the new Bolender gear-grinding chuck for holding gears accurately for internal grinding.

MULTIPLE-OPERATION TOOLS. Gairing Tool Co., 21 West Woodbridge St., Detroit, Mich. Circular illustrating various multiple-operation tools for drilling, counterboring, spot-facing, reaming, tapping, etc., simultaneously.

TURRET LATHES. Jones & Lamson Machine Co., Springfield, Vt. Circular illustrating different positions of the turret on the J & L turret lathe for a specific job. The time for each step in the sequence of operations is given.

OPEN-SIDE PLANERS. Cleveland Planer Co., 3148 Superior Ave., Cleveland, Ohio. Bulletin describing the features of the new Cleveland improved design open-side planers. Complete specifications for the various sizes are included.

ELECTRICAL FITTINGS. Crouse-Hinds Co., Syracuse, N. Y. Advance sheets Nos. 97, 98, 99, and 100, containing data on "Wedgtite" pipe hangers; telephone jack condulets; self-threading unions and connectors; and mine signal switches.

PRESSED-STEEL REELS AND SPOOLS. Mossberg Pressed Steel Corporation, Attleboro, Mass. Catalogue 104, describing and listing some of the many pressed-steel reels, spools, and other appliances for the wire industry that have been developed by this company.

PULLEY GRINDERS. Graham Mfg. Co., 71 Willard Ave., Providence, R. I. Circular L, descriptive of the Graham pulley grinder—a ring-wheel machine for finishing the belt surface of metal pulleys by grinding from the rough, leaving a straight or crowned face.

GRINDING WHEELS. Sterling Grinding Wheel Co., Tiffin, Ohio. Third edition of a booklet entitled "The Art and Science of Grinding," containing helpful information on grinding, including numerous tables of grades, grains, and sizes of wheels and other pertinent data.

GAS AUTOMATIC SHAPE-CUTTING MACHINE. Thomas Smith Co., 288 Grove St., Worcester, Mass. Circular illustrating and describing a machine for cutting steel shapes by means of mechanically controlled torches. Various examples of work cut on this machine are illustrated.

AUGER BITS. Greenlee Tool Co., Rockford, Ill. Pamphlet entitled "The Making of an Auger Bit," describing in detail the successive steps in the series of operations employed in producing auger bits at this company's plant. The large number of illustrations make the description easily followed.

ROLLER CHAIN. Diamond Chain & Mfg. Co., 409 Kentucky Ave., Indianapolis, Ind. Booklet 104, entitled "Simplifying and Improving Machine Design," containing a large number of illustrations of applications of both single- and multiple-strand chain as internal drives in a wide variety of industries.

ELECTRICAL MEASURING INSTRUMENTS. Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa. Circular entitled, "Signals of Good Management," showing how the temperature of heat-treating furnaces can be accurately and sensitively controlled by L. & N. potentiometer pyrometers.

CENTRIFUGAL SEPARATORS. National Acme Co., Positive Machinery Division, East 131st St. and Coit Road, Cleveland, Ohio. Booklet C, illustrating and describing the "Positive" centrifugal clarifier and centrifugal separator. The construction of these machines is described in detail and made clear by the use of numerous illustrations.

MILLING ATTACHMENTS. Porter-Cable Machine Co., Syracuse, N. Y. Booklet on Porter-Cable milling attachments, telling how these attachments operate and the kind of work for which each type is adapted. A number of illustrations, showing different installations of the attachments, are included. The booklet also illustrates and describes the new style Porter-Cable tapered end-mills for pattern work and rotary file.

ELECTRICAL EQUIPMENT. General Electric Co., Schenectady, N. Y. Circular GEA-712A, illustrating and describing type BTA adjustable-speed alternating-current motors. Bulletin GEA-919, dealing with improved brush-holders for railway motors. Circular GEA-920, treating of field coils with spring pads for railway motors. Bulletin GEA-930, illustrating and describing G-E pot-type electric furnaces for lead hardening.

NICKEL-ALLOY STEEL. International Nickel Co., 67 Wall St., New York City. Circular entitled "Roller Bearings in Railroad Service," giving performance records of the Chicago, Milwaukee & St. Paul Railroad heavy limited trains equipped with roller bearings. Bulletin entitled "Nickel Alloy Steels for Roller Bearings," describing the details of construction of nickel alloy steel roller bearings carrying heavy loads at high speeds.

MOTORS. Master Electric Co., Linden and Master Aves., Dayton, Ohio. Form 388, entitled "'Reel' Facts About the Master Electric Co.," illustrating different departments in the plant as well as typical Master motors. Price book No. 79, containing complete specifications, including prices, of Master alternating-current single-phase motors, alternating-current polyphase motors, direct-current compound-wound motors, and miscellaneous types.

ROLLER BEARINGS. Rollway Bearing Co., Inc., Syracuse, N. Y. Catalogue 4-A, containing data on the line of Rollway cylindrical roller bearings, of the wide series and utility types. Bulletin 53, descriptive of Rollway self-aligning roller-bearing pillow blocks. Bulletin 54, containing identification chart and key to dimensions of precision types of Rollway radial bearing pillow blocks with standard bearings. Bulletin 56, giving dimensions and rated load bearings. Bulletin 55, descriptive of roller-capacities of large Rollway bearings in international standard sizes.